

# **28th Annual Meeting of the North American Membrane Society (NAMS 2019)**

Pittsburgh, Pennsylvania, USA  
11-15 May 2019

ISBN: 978-1-7138-2787-0

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## ORAL SESSIONS

Presenting authors are indicated by an asterisk\*. See the most up-to-date version of the program with abstracts at [nams2019.org](http://nams2019.org) or via the **Attendify (NAMS 2019)** app.

### Plenary Session 1

**7:45 am - 9:00 pm | Ballroom 1**

**Dr. Peter S. Fiske**

Lawrence Berkeley National Laboratory

**Innovation Pathways in the Water Ecosystem:  
The PAX Water Story**

### #1 Processes: Fundamentals of Predicting and Preventing Membrane Fouling ...pg. 1

**9:30 am - 12:30 pm | Kings Garden 4**

**Co-Chairs:** Manish Kumar (Penn State University), Davide Mattia (University of Bath), Saifur Rahaman (Concordia University)

**9:30 am MONDAY**

#### 1a - Hydrodynamic-colloidal interactions of an oil droplet and a membrane surface

Mariano Galvagno (Technion - Israel Institute of Technology), Guy Z Ramon (Technion - Israel Institute of Technology)\*

**10:00 am MONDAY**

#### 1b - Do Graphene Oxide Nanostructured Coatings Mitigate Bacterial Adhesion to Membrane Interfaces?

Santiago Romero-Vargas Castrillon (University of Edinburgh)\*, Sara BinAhmed (University of Minnesota), Karl Wuolo-Journey (University of Minnesota)

**10:30 am MONDAY**

#### 1c - Fouling mechanisms in constant flux crossflow ultrafiltration

Alon Kirschner (The University of Texas at Austin)\*, Yu-Heng Cheng (The University of Texas at Austin), Donald Paul (The University of Texas at Austin), Robert Field (University of Oxford), Benny Freeman (The University of Texas at Austin)

**11:00 am MONDAY**

#### 1d - Fouling-Resistant, Multi-Functional Membranes with Ultra-Thin Hydrogel Selective Layers using Interfacially Initiated Free Radical Polymerization (IIFRP)

Ayşe Asatekin (Tufts University)\*, Ilin Sadeghi (Tufts University), Eric Liu (Tufts University), Alice Oliveira Aguiar (Tufts University), Hyunmin Yi (Tufts University)

**11:30 am MONDAY**

#### 1e - Unravel the Gordian Knot of membrane desalination: Understanding and mitigating silica scaling in reverse osmosis

Tiezheng Tong (Colorado State University)\*, Song Zhao (Tianjin University), Amanda Quay (Carnegie Mellon University), Yunlong Qi (Tianjin University)

**12:00 pm MONDAY**

#### 1f - RO Mineral Scale Mitigation via Self-Adaptive Feed-Flow Reversal

Yeunha Kim (UCLA)\*, Anditya Rahardianto (UCLA), Tae Lee (UCLA), Yoram Cohen (UCLA)

### #2 Processes: Membrane Distillation and Pervaporation: Innovations in Process Design and Scalability ...pg 3

**9:30 am - 12:30 pm | Ballroom 3**

**Co-Chairs:** Lee Vane (Environmental Protection Agency), David Warsinger (Purdue University)

**9:30 am MONDAY**

#### 2a - Continuous on-demand dehydration of solvents in flow chemistry manufacturing processes

Hannah Murnen (Compact Membrane Systems)\*, Sudip Majumdar (Compact Membrane Systems)

**10:00 am MONDAY**

#### 2b - How membrane technology has been successfully applied to ethanol processing

Stephan Blum (Whitefox Technologies)\*, Trond Heggenhougen (Whitefox Technologies), Meridith K. Bridge (Whitefox Technologies)

**10:30 am MONDAY****2c - Modeling the effect of different single-walled carbon nanotube orientations on permeation through mixed matrix membranes**

Ali Zamani (University of Ottawa)\*, Jules Thibault (University of Ottawa), Handan Tezel (University of Ottawa)

**11:00 am MONDAY****2d - Unique 3D printed spacers for process enhancement in membrane distillation**

Navya Thomas (Khalifa University)\*, Nurshaun Sreedhar (Khalifa University), Oraib Al-Ketan (Khalifa University), Reza Rowshan (New York University Abu Dhabi), Rashid Abu Al-Rub (Khalifa University), Hassan Arafat (Khalifa University)

**11:30 am MONDAY****2e - 2D boron nitride encapsulated nanofiber membranes for membrane distillation**

Yunchul Woo (Korea Institute of Civil Engineering and Building Technology)\*, Ho Kyong Shon (University of Technology Sydney), June-Seok Choi (Korea Institute of Civil Engineering and Building Technology)

**12:00 pm MONDAY****2f - Impact of membrane properties on scaling-induced wetting in membrane distillation**

Allyson L McGaughey (University of Southern California)\*, Prathamesh Karandikar (University of Southern California), Malancha Gupta (University of Southern California), Amy Childress (University of Southern California)

### #3 Applications: Seawater Desalination ...pg. 6

**9:30 am - 12:30 pm | Kings Garden 3**

**Co-Chairs:** Sunny Jiang (UC Irvine), Bill Phillip (University of Notre Dame)

**9:30 am MONDAY****3a - Sacrificial Protective Layer for Fouling Control in Reverse Osmosis Desalination**

Moon Son (Penn State University)\*, Wulin Yang (Penn State University), Szilard S. Bucs (King Abdullah University of Science and Technology), Maria F. Nava-Ocampo (King Abdullah University of Science and Technology), Johannes S. Vrouwenvelder (King Abdullah University of Science and Technology), Bruce E. Logan (Penn State University)

**10:00 am MONDAY****3b - Water Transport through Ultrathin Polyamide Nanofilms Used for Reverse Osmosis**

Zhiwei Jiang (Imperial College London)\*, Santanu Karan (Imperial College London), Andrew Livingston (Imperial College London)

**10:30 am MONDAY****3c - Balancing Carbon, Nitrogen and Phosphorus Concentration in Seawater as a Strategy to Prevent Accelerated Membrane Biofouling**

Siqian (Simon) Huang (University of Minnesota, Duluth), Nikolay Voutchkov (Water Globe Consultants, LLC), Sunny Jiang (UC Irvine)\*

**11:00 am MONDAY****3d - Flow Reversal for Increased Recovery of 2nd Pass Seawater RO**

Tomer Osman (Rotec Water Ltd.), Dan Peled (AST-Water Ltd.), Noam Perlmutter (Rotec Water Ltd.), Arina Shulman (Mekorot Water Company), Riki Harpness (Mekorot Water Company), Sivan Bleich (Mekorot Water Company), Eli Korin (Ben-Gurion University of the Negev), Jack Gilron (Ben-Gurion University of the Negev)\*

**11:30 am MONDAY****3e - Zwitterionic poly(arylene ether sulfone) (PAES) copolymer for biofouling/chlorine resistant desalination membranes**

Yi Yang (Arizona State University)\*, Matthew Green (Arizona State University)

**12:00 pm MONDAY****3f - Chlorine resistance of functionalized HNTs-based TFN membranes**

Farhad Asempour (University of Ottawa), Somaye Akbari (Amirkabir University of Technology), Du Bai (University of Ottawa), Ramzi Aoun (University of Ottawa), Sofia Reyes Lombardo (University of Ottawa), Amirsajad Atashgar (University of Ottawa), Boguslaw Kruczek (University of Ottawa)\*

#### #4 Materials: Selective Polymeric and Mixed-Matrix Materials - Liquid Separations ...pg. 9

9:30 am - 12:30 pm | Ballroom 4

**Co-Chairs:** Dan Miller (Lawrence Berkeley National Laboratory), Baoxia Mi (UC Berkeley)

9:30 am MONDAY

##### 4a - Enantioselective Polymeric Membrane for Chiral Separation of Enantiomers

Marine Michel (Imperial College London)\*

10:00 am MONDAY

##### 4b - Tailored Synthesis of Inorganic-supported Polymer, Graphene, and Nanocomposite Membranes for Liquid-phase Separations

Michael Z Hu (Oak Ridge National Laboratory)\*

10:30 am MONDAY

##### 4c - Two-Dimensional (2D) Covalent Organic Framework Mixed-Matrix Membranes

Phuoc Duong (University of Wyoming), Valerie Kuehl (University of Wyoming), Bruce Mastorovich (University of Wyoming), John Hoberg (University of Wyoming), Bruce Parkinson (University of Wyoming), Katie D Li-Oakey (University of Wyoming)\*

11:00 am MONDAY

##### 4d - Enhancing water permeance in reduced graphene oxide membranes by chemical etching

Xiaoyi Chen (The State University of New York at Buffalo)\*, Liang Huang (The State University of New York at Buffalo), Zhihao Feng (The State University of New York at Buffalo), Janavi Gohil (The State University of New York at Buffalo), Haiqing Lin (The State University of New York at Buffalo)

11:30 am MONDAY

##### 4e - Nanocomposite RO Membranes with High Aspect Ratio Functional Nanoparticles for Controlled Interfacial Transport

Stephen M Martin (Virginia Tech)\*, Ethan Smith (Virginia Tech), E. Johan Foster (Virginia Tech), Keith Hendren (Virginia Tech), James Haag (Virginia Tech)

12:00 pm MONDAY

##### 4f - If one were to develop a new NF/RO membrane, specifically for uncharged organic solute rejection, how permeable could it be to water while meeting organic solute rejection goals?

Eric Hoek (UCLA)\*

#### #5 Materials: Inorganic Materials...pg.11

9:30 am - 12:30 pm | Kings Garden 1

**Co-Chairs:** Jay Knierp (Membrane Technology & Research), Jerry Lin (Arizona State University)

9:30 am MONDAY

##### 5a - Two-Dimensional Membranes for Gas Separation

Dan Zhao (National University of Singapore)\*

10:00 am MONDAY

##### 5b - Restricting Lattice Flexibility in Polycrystalline Metal-Organic Framework Membrane for Efficient Carbon Capture

Deepu Babu (L'Ecole polytechnique fédérale de Lausanne), Kumar Varoon Agrawal (L'Ecole polytechnique fédérale de Lausanne)\*

10:30 am MONDAY

##### 5c - New Asymmetric and Permselective Carbon Molecular Sieve Membranes

Jay (Junqiang) Liu (The Dow Chemical Company)\*, Ted Calverley (The Dow Chemical Company), Dean Millar (The Dow Chemical Company), Mark Brayden (The Dow Chemical Company), Marcos Martinez (The Dow Chemical Company)

11:00 am MONDAY

##### 5d - Hitz zeolite membrane separation system (HDS) for gas separation

Masaya Itakura (Hitachi Zosen Corporation)\*, Satoshi Imasaka (Hitachi Zosen Corporation), Kentaro Shinoya (Hitachi Zosen Corporation), Masashi Okada (Hitachi Zosen Corporation)

**11:30 am MONDAY****5e - Insights on the Carbon Molecular Sieve Structure from Stability and Rejuvenation Tendencies**

Samuel Hays (Georgia Institute of Technology)\*, Oishi Sanyal (Georgia Institute of Technology), Nicholas Leon (Georgia Institute of Technology), Chen Zhang (University of Maryland), Pezhman Arab (Georgia Institute of Technology), William Koros (Georgia Institute of Technology)

**12:00 pm MONDAY****5f - Fabrication of zeolitic imidazolate framework ZIF-8 membranes by ligand-induced permselectivation in vapor phase**

Xiaoli Ma (University of Wisconsin-Milwaukee)\*, Prashant Kumar (University of Minnesota), Nitish Mittal (University of Minnesota), Alexandra Khlyustova (University of Minnesota), Prodromos Daoutidis (University of Minnesota), Andre Mkhoyan (University of Minnesota), Michael Tsapatsis (Johns Hopkins University)

**#6 Applications: Assessing Performance, Robustness, and Scalability for Carbon Capture ...pg 13**

**9:30 am - 12:30 pm | Kings Garden 5**

**Co-Chairs:** Dave Hopkinson (U.S. Department of Energy National Energy Technology Laboratory), Winston Ho (Ohio State University)

**9:30 am MONDAY****6a - Polymers with Side Chain Porosity for Ultraparpermeable and Plasticization Resistant Materials for Gas Separations**

Sharon Lin (MIT)\*, Francesco Benedetti (University of Bologna), Yuan He (MIT), Chao Liu (University of Chinese Academy of Sciences), Yanchuan Zhao (University of Chinese Academy of Sciences), Hong-Zhou Ye (MIT), Troy Van Voorhis (MIT), Maria Grazia De Angelis (University of Bologna), Timothy Swager (MIT), Zach Smith (MIT)

**10:00 am MONDAY****6b - Bench scale testing of next generation hollow fiber membrane modules at subambient conditions at the National Carbon Capture Center**

David Hasse (Air Liquide)\*, Shilu Fu (Air Liquide), Sudhir Kulkarni (Air Liquide), Trapti Chaubey (Air Liquide), Alex Augustine (Air Liquide), Andrew Hamilton (Air Liquide), Monaca Mcnall (Air Liquide)

**10:30 am MONDAY****6c - A Carbon Molecular Sieve Membrane-Based Reactive Separation Process for Pre-Combustion CO<sub>2</sub> Capture**

Mingyuan Cao (University of Southern California), Linghao Zhao (University of Southern California), Dongwan Xu (University of Southern California), Secgin Karagoz (UCLA), Patricia Pichardo (UCLA), Richard J. Ciora, Jr. (Media and Process Technology, Inc.), Paul Kt Liu (Media and Process Technology, Inc.), Vasilios I. Manousiouthakis (UCLA), Theodore T Tsotsis (University of Southern California)\*

**11:00 am MONDAY****6d - Synthesis of Polymers of Intrinsic Microporosity (PIM-1) with Poly(ethylene glycol) for Membrane Application**

Volkan Filiz (Helmholtz-Zentrum Geesthacht)\*, Gisela Bengtson (Helmholtz-Zentrum Geesthacht), Silvio Neumann (Helmholtz-Zentrum Geesthacht)

**11:30 am MONDAY****6e - High-permeance polymer-functionalized graphene membranes that surpass the postcombustion carbon capture target**

Guangwei He (L'Ecole polytechnique fédérale de Lausanne), Kumar Varoon Agrawal (L'Ecole polytechnique fédérale de Lausanne)\*

**12:00 pm MONDAY****6f - Fabrication of Thin Film Composite Membranes using Microporous Polymer Blends and Polybenzimidazole Nanoporous Supports for CO<sub>2</sub>/N<sub>2</sub> Separation**

Lingxiang Zhu (U.S. Department of Energy National Energy Technology Laboratory)\*, Surendar Venna (U.S. Department of Energy National Energy Technology Laboratory), Ali Sekizkardes (Battelle/ U.S. Department of Energy National Energy Technology Laboratory), Victor A Kusuma (U.S. Department of Energy National Energy Technology Laboratory), David Hopkinson (U.S. Department of Energy National Energy Technology Laboratory)

**#7 Applications: Assessing Performance, Robustness, and Scalability for Carbon Capture ...pg 16**

**2:00 pm - 5:00 pm | Kings Garden 5**

**Co-Chairs:** Dave Hopkinson (U.S. Department of Energy National Energy Technology Laboratory), Winston Ho (Ohio State University)

**2:00 pm MONDAY****7a - Field trial of spiral-wound facilitated transport membrane module for CO<sub>2</sub> capture from flue gas**

Yang Han (Ohio State University)\*, Witopo Salim (Ohio State University), Kai Chen (Ohio State University), Dongzhu Wu (Ohio State University), Winston Ho (Ohio State University)

**2:30 pm MONDAY****7b - Gen-2 Proteus™ membrane and module development for CO<sub>2</sub> capture from gasification streams**

Witopo Salim (Membrane Technology & Research Inc.)\*, Karl Amo (Membrane Technology & Research Inc.), Trevor Carlisle (Oregon State University), Richard Baker (Membrane Technology & Research Inc.), Jenny He (Membrane Technology & Research Inc.), Jay Knip (Membrane Technology & Research Inc.), Tim Merkel (Membrane Technology & Research Inc.), Vincent Nguyen (Membrane Technology & Research Inc.), Zhen Sun (Membrane Technology & Research Inc.), Jonathan Tan (Membrane Technology & Research Inc.), Bob Watson (Membrane Technology & Research Inc.), Erik Westling (Membrane Technology & Research Inc.)

**3:00 pm MONDAY****7c - One-pot surface modification of nanocellulose fibrils and effect of manipulated fibril surfaces in Hybrid Facilitated Transport Membranes for CO<sub>2</sub> capture**

Saravanan Janakiram (Norwegian University of Science and Technology)\*, Xinyi Yu (Norwegian University of Science and Technology), Luca Ansaloni (SINTEF Industry), Zhongde Dai (Norwegian University of Science and Technology), Liyuan Deng (Norwegian University of Science and Technology)

**3:30 pm MONDAY****7d - DDR-type zeolite membrane: The first opportunity in CO<sub>2</sub>-EOR industry**

Junya Okazaki (JGC Corporation)\*, Hiroaki Hasegawa (JGC Corporation), Nobuyasu Chikamatsu (JGC Corporation), Kenji Yajima (NGK Insulators), Katsuya Shimizu (NGK Insulators), Makiko Niino (NGK Insulators)

**4:00 pm MONDAY****7e - Coating of hollow fiber membrane for carbon molecular sieve membrane preparation**

Yuhe Cao (Georgia Institute of Technology)\*, Kuang Zhang (Georgia Institute of Technology), Oishi Sanyal (Georgia Institute of Technology), William Koros (Georgia Institute of Technology)

**4:30 pm MONDAY****7f - Ultrapervious benzotriptycene-based PIMs that redefine the upper bounds for CO<sub>2</sub> separations**

Alessio Fuoco (National Research Council of Italy)\*, Bibiana Comesaña-Gándara (University of Edinburgh), Jie Chen (University of Edinburgh), Grazia Bezzu (University of Edinburgh), Mariolino Carta (Swansea University), Ian Rose (University of Edinburgh), Maria-Chiara Ferrari (University of Edinburgh), Johannes Carolus (John) Jansen (National Research Council of Italy), Elisa Esposito (National Research Council of Italy), Marcello Monteleone (National Research Council of Italy), Neil McKeown (University of Edinburgh)

## #8 Processes: Innovations in Module Modeling and Design ...pg. 19

2:00 pm - 5:00 pm | Ballroom 3

**Co-Chairs:** David Ladner (Clemson University), Grigori Panagakos (U.S. Department of Energy National Energy Technology Laboratory)

2:00 pm MONDAY

### 8a - CFD simulation of crimped hollow fiber membranes for liquid separation processes

Mohammad Younas (University of Engineering and Technology, Peshawar)\*, Amir Muhammad (University of Engineering and Technology, Peshawar), Glenn Lipscomb (University of Toledo)

2:30 pm MONDAY

### 8b - Computational Fluid Dynamics Modeling for the Investigation of Multi-Layer Spacer Effects

Zachary Binger (The University of Arizona), Andrea Achilli (The University of Arizona)\*

3:00 pm MONDAY

### 8c - Direct numerical simulation of unsteady mixing in direct contact membrane distillation systems with membrane spacers

Jincheng Lou (Colorado School of Mines)\*, Jacob Johnston (Colorado School of Mines), Nils Tilton (Colorado School of Mines)

3:30 pm MONDAY

### 8d - Concentration polarization modeling for high-pressure membranes with engineered surface features

Zuo Zhou (Clemson University)\*, David Ladner (Clemson University), Sapna Sarupria (Clemson University), Steven Weinman (Clemson University), Scott Husson (Clemson University), Ilenia Battiato (Stanford University), Negin Kananizadeh (Clemson University)

4:00 pm MONDAY

### 8e - Analysis of Micromixers to Minimize Scaling Effects on Reverse Osmosis Membranes

Jeremy Walker (U.S. Army)\*, Shawn McElmurry (Wayne State University), James Dusenbury (U.S. Army)

4:30 pm MONDAY

### 8f - Do Hydrodynamic Instabilities Cause Roughness in Thin Polyamide Films of Reverse Osmosis Membranes?

Akshay Deshmukh (Yale University)\*, Puskar Mondal (Yale University), Subhajyoti Chaudhuri (Yale University), Menachem Elimelech (Yale University)

## #9 Processes: Osmotically-Driven Membrane Processes for Water and Energy ...pg. 22

2:00 pm - 5:00 pm | Ballroom 4

**Co-Chairs:** Tony Straub (University of Colorado Boulder/MIT), Aaron Wilson (Idaho National Lab), Emily Tow (Olin College), Chris Gorski (Penn State University), Kitty Nijmeijer (Eindhoven University of Technology)

2:00 pm MONDAY

### 9a - Structural and Transport Properties of Membranes in High-Salinity Desalination using Cascading Osmotically Mediated Reverse Osmosis

Xi Chen (Columbia University)\*, Chanhee Boo (Columbia University), Ngai Yin Yip (Columbia University)

2:30 pm MONDAY

### 9b - Utilization of reverse solute diffusion to enhance membrane performance during osmotically driven processes - improved boron retention and silica scaling mitigation

Yining Wang (Nanyang Technological University)\*, Weiyi Li (Southern University of Science and Technology), Chuyang Tang (University of New South Wales), Rong Wang (Nanyang Technological University)

3:00 pm MONDAY

### 9c - Osmotic Membrane Desalination Performance Governed by Molecular Reflection at the Liquid-Vapor Interface

Akshay Deshmukh (Yale University), Jongho Lee (University of British Columbia)\*



**3:30 pm MONDAY****9d - Characterization of External and Internal Fouling of Forward Osmosis (FO) Process Through Ultrasonic Time Domain Reflectometry (UTDR) Method**

Li Lai (Nanyang Technological University)\*, Tzyy Haur Chong (Singapore Membrane Technology Centre)

**4:00 pm MONDAY****9e - Incorporating membrane deformation into the boundary layer equation to model water and reverse salt flux in osmotic processes**

Jaime A Idarraga-Mora (Clemson University)\*, Alton O'Neal (Clemson University), Morgan Pfeiler (Clemson University), David Ladner (Clemson University), Scott Husson (Clemson University)

**4:30 pm MONDAY****9f - A Thin-Film Forward-Osmosis Membrane Made from a Graphene Oxide-Silver Metal-Organic Framework Nanocomposite: Antifouling and Antibiofouling Assessment**

Mostafa Dadashi Firouzjaei (University of Alabama), Ahmad Arabi Shamsabadi (Drexel University), Mohammad Sharifian Gh (University of Virginia), Milad Rabbani Esfahani (University of Alabama)\*, Ahmad Rahimpour (Babol Noshirvani University of Technology), Masoud Soroush (Drexel University)

**#10 Applications: Water Reuse ...pg. 25**

**2:00 pm - 5:00 pm | Kings Garden 4**

**Co-Chairs:** Pei Xu (New Mexico State University), Jack Gilron (Ben-Gurion University of the Negev)

**2:00 pm MONDAY****10a - Tannic acid-iron network based green technique for enhanced membrane performance in water reuse**

Hao Guo (The University of Hong Kong)\*

**2:30 pm MONDAY****10b - Membrane Distillation (MD) and Reverse Osmosis (RO) processes for water recovery from pre-treated high strength brewery wastewater**

Nawrin Anwar (Concordia University)\*, Mahbuboor Choudhury (Concordia University), Saifur Rahaman (Concordia University)

**3:00 pm MONDAY****10c - Field Demonstration of Real-Time Colloidal Particle Monitoring to Improve MF and UF Membrane Performance**

Jana Safarik (Orange County Water District)\*, Ganesh Rajagopalan (Kennedy/Jenks Consultants), Helia Safaee (Kennedy/Jenks Consultants), Megan Plumlee (Orange County Water District), Zita Yu (West Basin Municipal Water District)

**3:30 pm MONDAY****10d - Selective removal of phosphorus from wastewater using electromembrane process**

Sanhita Chaudhury (Ben-Gurion University of the Negev)\*, Oded Nir (Ben-Gurion University of the Negev)

**4:00 pm MONDAY****10e - Water Recovery from Produced Water via Robust Membrane Distillation**

Rong Wang (Nanyang Technological University)\*

**4:30 pm MONDAY****10f - Potable-quality water recovery from primary effluent through an integrated algal-osmosis membrane system**

Lu Lin (New Mexico State University)\*, Wenbin Jiang (New Mexico State University), Pei Xu (New Mexico State University)

## #11 Materials: Ion-Exchange and Electrofunctional Materials ...pg. 28

2:00 pm - 5:00 pm | Kings Garden 1

**Co-Chairs:** Geoff Geise (University of Virginia), Orlando Coronell (University of North Carolina at Chapel Hill)

### 2:00 pm MONDAY

#### 11a - Ion Transport Through Perforated Nanoporous Graphene

Mandakranta Ghosh (University of Twente)\*, Koen F. A. Jorissen (University of Twente), Jeffery A. Wood (University of Twente), Rob G. H. Lammertink (University of Twente)

### 2:30 pm MONDAY

#### 11b - Developing a new approach to describe ion sorption and transport in Nafion membranes

Rahul Sujanani (The University of Texas at Austin)\*, Jovan Kamcev (UC Berkeley), Eui-Soung Jang (The University of Texas at Austin), Benny Freeman (The University of Texas at Austin), Donald Paul (The University of Texas at Austin)

### 3:00 pm MONDAY

#### 11c - Co-transport of neutral solutes in Nafion 117 using In-situ ATR FTIR spectroscopy for multicomponent solution speciation

Breanna Dobyys (Auburn University)\*, Bryan S Beckingham (Auburn University)

### 3:30 pm MONDAY

#### 11d - Functionalized Nanoporous Ceramic Membranes Towards Low-Cost Electrodialysis

Gregory M Newbloom (Membrion, Inc.)\*, Ryan Kingsbury (Membrion, Inc.), Rachel Malone (Membrion, Inc.)

### 4:00 pm MONDAY

#### 11e - Polymerization of counterions in self-assembled, 1 nm pores of lyotropic liquid crystal anion exchange membrane to tune nanopore and ion transport properties

Michael J. McGrath (University of Colorado at Boulder)\*, Samantha Hardy, Andrew Basalla (University of Colorado Boulder), Hans Funke (University of Colorado Boulder), Bryce Manubay (University of Colorado Boulder), Zhangxing Shi (University of Colorado Boulder), Douglas Gin (University of Colorado Boulder), Richard Noble (University of Colorado Boulder)

### 4:30 pm MONDAY

#### 11f - Quantifying tortuosity and diffusion over multiple scales in ionic and non-ionic polymer membranes

Louis Madsen (Virginia Tech)\*

## #12 Materials: Membrane Material and Transport Simulation: Molecular & Process Modeling of Membranes ...pg. 30

2:00 pm - 5:00 pm | Kings Garden 3

**Co-Chairs:** Chris Wilmer (University of Pittsburgh), Abhishek Roy (The Dow Chemical Company)

### 2:00 pm MONDAY

#### 12a - Expanding the chemical palette for reliable chemical separations using molecular simulations and machine learning

David Sholl (Georgia Institute of Technology)\*, Farhad Gharagheizi (Georgia Institute of Technology), Dai Tang (Georgia Institute of Technology)

### 2:30 pm MONDAY

#### 12b - Diffusion, Reaction, and Network Structure Modeling of Interfacial Polymerization of Polyamide Membranes

Jeffrey D Wilbur (DuPont Water Solutions)\*, Toni Bechtel (DuPont Water Solutions), Matthew Jansma (DuPont Water Solutions), Steve Rosenberg (DuPont Water Solutions), Dan Arriola (DuPont Water Solutions)

**3:00 pm MONDAY****12c - Optimization of Mixed Matrix Membrane Materials for Post-Combustion Carbon Capture**

Janice A. Steckel (U.S. Department of Energy National Energy Technology Laboratory)\*, Samir Budhathoki (U.S. Department of Energy National Energy Technology Laboratory), Miguel Zamarripa-Perez (U.S. Department of Energy National Energy Technology Laboratory), Paul Boone (University of Pittsburgh), Christopher Wilmer (University of Pittsburgh)

**3:30 pm MONDAY****12d - Diffusivity in anion exchange membranes under low hydration: A molecular dynamics study**

Dario Dekel (Technion - Israel Institute of Technology), Israel Zadok (Technion - Israel Institute of Technology), Srdan Pusara (Technion - Israel Institute of Technology), Simcha Srebnik (Technion - Israel Institute of Technology)\*

**4:00 pm MONDAY****12e - Modeling of polymer membrane formation via phase inversion by mesoscopic phase-field methods: Investigating the development of structure on multiple scales**

Michael R Cervellere (University of Arkansas/EMD Millipore)\*, Xianghong Qian (University of Arkansas), David Ford (University of Arkansas), Paul Millett (University of Arkansas)

**4:30 pm MONDAY****12f - Multiscale Modeling of Gas Permeation Through Poly(Dimethyl Phenylene Oxide) (PPO) and Its Pre-Steady State Polymer Response**

Marielle Soniat (Lawrence Berkeley National Laboratory)\*, Meron Tesfaye (Lawrence Berkeley National Laboratory), Daniel Brooks (CalTech), Nicholas Humphrey (USC), Lien-Chun Weng (Lawrence Berkeley National Laboratory), Boris Merinov (CalTech), William Goddard (CalTech), Adam Weber (Lawrence Berkeley National Laboratory), Frances Houle (Lawrence Berkeley National Laboratory)

**Plenary Session 2****7:45 am - 9:00 pm | Ballroom 1****Dr. Tim Merkel**

Membrane Technology and Research, Inc.

**Development of Membranes for CO<sub>2</sub> Capture****#13 Processes: Process Innovations in Electrofunctional and Electrocatalytic Membrane Processes ...pg. 33****9:30 am - 12:30 pm | Kings Garden 4****Co-Chairs:** Charles-François de Lannoy (McMaster University), David Jassby (UCLA)**9:30 am TUESDAY****13a - Scaling mitigation in membrane distillation through electrokinetic mixing**

Unnati Rao (UCLA)\*, Guy Z Ramon (Technion - Israel Institute of Technology), Eric Hoek (UCLA), David Jassby (UCLA)

**10:00 am TUESDAY****13b - Donnan dialysis desalination with thermolytic salts**

Hanqing Fan (Columbia University)\*, Ngai Yin Yip (Columbia University)

**10:30 am TUESDAY****13c - Electrically Conductive Membranes as Sensors: Stability, Conductivity, and Sensitivity**

Nan Zhang (McMaster University), Amin Halali (McMaster University), Charles-François de Lannoy (McMaster University)\*

**11:00 am TUESDAY****13d - Electrocatalytic Membrane Reactor-based Integrated Processes for Landfill Leachate Treatment**

Jianxin Li (Tianjin Polytechnic University)\*, Hong Wang (Tianjin Polytechnic University), Junhao Ding (Tianjin Polytechnic University)

**11:30 am TUESDAY****13e - Nitrogen and Phosphorus Recovery from Agricultural Wastewater Effluents - Role of Electrically Conductive Membranes**

Avner Ronen (Temple University)\*, Kartikeya Kekre (Temple University)

**12:00 pm TUESDAY****13f - Simulations of Highly Selective Separations Based on Electromigration**

Merlin Bruening (University of Notre Dame)\*, Andriy Yaroshchuk (Polytechnic University of Catalonia), Mykola Bondarenko (National Academy of Sciences of Ukraine), Chao Tang (University of Notre Dame), Muhammad Ahmad (University of Notre Dame)

**#14 Applications: Contaminant Removal from Water Sources ...pg. 36****9:30 am - 12:30 pm | Ballroom 3****Co-Chairs:** Andre da Costa (Michigan Technological University), Prakhar Prakash (Chevron - RPE)**9:30 am TUESDAY****14a - Oil drop behavior on model nanofiltration membrane surfaces under conditions of hydrodynamic shear**

Emily Tummons (Michigan State University), Charifa Hejase (Michigan State University)\*, Zhefei Yang (University of Massachusetts Amherst), Jia Wei Chew (Nanyang Technological University), Merlin Bruening (University of Notre Dame), Vlad Tarabara (Michigan State University)

**10:00 am TUESDAY****14b - A case study review of the application of reverse osmosis membranes for water treatment and reagent recovery at mining and mineral processing operations**

Chris Biederman (Hatch)\*, Jeffrey Cobbledick (Hatch)

**10:30 am TUESDAY****14c - Self-Cleaning Nanocomposite Membranes with Phosphorene-Based Pore Fillers for Water Treatment**

Joyner Eke (University of Kentucky)\*, Isabel Escobar (University of Kentucky)

**11:00 am TUESDAY****14d - Optimization of nanofiltration process for treating industrial wastewater of time-varying composition**

Salman Alizadeh Kordkandi (McMaster University); Ryan LaRue (McMaster University)\*; Abhishek Premachandra (McMaster University); Jacob Sitko (McMaster University); David Latulippe (McMaster University)

**11:30 am TUESDAY****14e - Adsorptive and Reactive Membranes for Remediation of PFOA, Chloro-organics, and RCRA Metals from Water**

DB Bhattacharyya (University of Kentucky)\*, Hongyi (Derek) Wan (University of Kentucky), Anthony Saad (University of Kentucky), Md. Saiful Islam (University of Kentucky), Ashish Aher (University of Kentucky), Rollie Mills (University of Kentucky), Lindell Ormsbee (University of Kentucky), Evan Hatakeyama (Chevron)

**12:00 pm TUESDAY****14f - Selective separation of mono- and di-valent cations in electrodialysis during brackish water desalination: bench and pilot-scale studies**

Xuesong Xu (New Mexico State University)\*, Pei Xu (New Mexico State University), Guanyu Ma (New Mexico State University)

**#15 Materials: Materials for Organic Solvent Separations ...pg. 39**

**9:30 am - 12:30 pm | Ballroom 4**

**Co-Chairs:** Steve White (Membrane Technology & Research Inc.), Ryan Lively (Georgia Institute of Technology)

**9:30 am TUESDAY****15a - Membrane solvent recovery in edible oil industry**

Petrus Cuperus (SolSep BV)\*, Ingrid Wienk (SolSep BV), Pieter Vandezande (VITO), Marco Pipolo (Bunge), Jan Kolijn (TUSTI), Will Fuchten (MTSA)

**10:00 am TUESDAY****15b - Molecular Design of Polymeric Membranes for Organic Solvent Recovery**

Tai-Shung Chung (National University of Singapore)\*

**10:30 am TUESDAY****15c - Epoxy-based solvent resistant nanofiltration membranes prepared through phase inversion**

Maarten Bastin (KU Leuven)\*, Jasper Raymenants (KU Leuven), Ivo Vankelecom (KU Leuven)

**11:00 am TUESDAY****15d - Nanoporous Graphene Membranes for Organic Solvent Nanofiltration**

David Cheng (MIT)\*, Rohit Karnik (MIT)

**11:30 am TUESDAY****15e - OSN Technology in Petrochemical Industry: Looking Back, Looking Forward**

Dhaval Bhandari (ExxonMobil), JR Johnson\* (ExxonMobil)

**12:00 pm TUESDAY****15f - Enabling Organic Solvent Nanofiltration and Reverse Osmosis using Ceramic Supported TFC Membranes**

Jeffrey R McCutcheon (University of Connecticut)\*, Lingling Xia (University of Connecticut), Marcus Weyd (Fraunhofer Institute for Ceramic Technologies and Systems IKTS), Mi Zhang (University of Connecticut)

## #16 Materials: Catalytic and Responsive Materials ...pg. 41

9:30 am - 12:30 pm | Kings Garden 3

**Co-Chairs:** Miao Yu (Rensselaer Polytechnic Institute), Ayse Asatekin (Tufts University)

### 9:30 am TUESDAY

#### 16a - Responsive CNT Composite Membranes for Protection Against Chemical Warfare Agents

Melinda L Jue (Lawrence Livermore National Laboratory)\*, Chiatai Chen (Cornell University), Yifan Li (MIT), Eric Meshot (Lawrence Livermore National Laboratory), Ngoc Bui (Lawrence Livermore National Laboratory), Rong Zhu (MIT), Myles Herbert (MIT), Sei Jin Park (Lawrence Livermore National Laboratory), Steven Buchsbaum (Lawrence Livermore National Laboratory), Kuang Jen Wu (Lawrence Livermore National Laboratory), Timothy Swager (MIT), Francesco Fornasiero (Lawrence Livermore National Laboratory)

### 10:00 am TUESDAY

#### 16b - Highly Efficient Dimethyl Ether Production from CO<sub>2</sub> Hydrogenation in a Dehydration Membrane Reactor

Huazheng Li (Rensselaer Polytechnic Institute)\*, Fanglei Zhou (Rensselaer Polytechnic Institute), Qiaobei Dong (Rensselaer Polytechnic Institute), Shoujie Ren (Missouri University of Science and Technology), Xinhua Liang (Missouri University of Science and Technology), Naomi Klinghoffer (Gas Technology Institute), Shiguang Li (Gas Technology Institute), Miao Yu (Rensselaer Polytechnic Institute)

### 10:30 am TUESDAY

#### 16c - Poly-methacrylic acid Functionalized Membranes with Incorporated Reactive Pd/Fe Nanoparticles: Lab Scale to Groundwater Remediation Applications

Hongyi (Derek) Wan (University of Kentucky)\*, Md. Saiful Islam (University of Kentucky), Nicolas Briot (University of Kentucky), Anthony Saad (University of Kentucky), Lindell Ormsbee (University of Kentucky), DB Bhattacharyya (University of Kentucky)

### 11:00 am TUESDAY

#### 16d - Investigation of a smart electrically responsive ultrafiltration membrane

Chia Miang Khor (UCLA)\*, David Jassby (UCLA)

### 11:30 am TUESDAY

#### 16e - Catalytic Membranes for Groundwater Treatment

Alexander J Sutherland (McMaster University)\*, Charles-François de Lannoy (McMaster University)

### 12:00 pm TUESDAY

#### 16f - Plasmonic membrane catalytic activation of peroxide for quantized oxidation via residence time control

Hao Tang (University of Washington), Guozheng Shao (University of Washington), Bruce Hinds (University of Washington)\*

## #17 Materials: Selective Polymeric and Mixed-Matrix Materials - Gas Separations ...pg. 44

9:30 am - 12:30 pm | Kings Garden 5

**Co-Chairs:** Ben Sundell (Aramco Services Company), Zach Smith (MIT)

### 9:30 am TUESDAY

#### 17a - Mixed-matrix membranes formed from imide-functionalized UiO-66-NH<sub>2</sub> for improved interfacial compatibility

Qihui Qian (MIT)\*, Zach Smith (MIT)

### 10:00 am TUESDAY

#### 17b - Janus polymers bearing tri(n-alkoxy)silyl side groups: glassy membrane materials with properties of rubbers

Yury P Yampolskii (A.V.Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences)\*, Ludmila Starannikova (A.V.Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences), Dmitry Alentiev (A.V.Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences), Maxim Bermeshev (A.V.Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences)

Sciences), Eugene Finkelshtein (A.V.Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences)

### 10:30 am TUESDAY

#### 17c - Solution processable metal organic frameworks for gas separations: from porous liquids to mixed matrix membranes

Anastasiya V Bavykina (King Abdullah University of Science and Technology)\*, Alexander Knebel (Leibniz University Hannover Institute for Physical Chemistry and Electrochemistry), Shuvo Datta (King Abdullah University of Science and Technology), Magnus Rueping (King Abdullah University of Science and Technology), Mohamed Eddaoudi (King Abdullah University of Science and Technology), Juergen Caro (Leibniz University Hannover Institute for Physical Chemistry and Electrochemistry), Jorge Gascon (King Abdullah University of Science and Technology)

### 11:00 am TUESDAY

#### 17d - Enhancing CO<sub>2</sub>/N<sub>2</sub> Selectivity and Elimination of Langmuir Sorption within High Tg, Glassy Polynorbornene Membranes

Christopher Maroon (University of Tennessee), Jacob Townsend (University of Tennessee), Kevin Gmernicki (University of Tennessee), Daniel Harrigan (Aramco Services Company), Ben Sundell (Aramco Services Company), John Lawrence (Aramco), Shannon Mahurin (Oak Ridge National Laboratory), Konstantinos Vogiatzis (University of Tennessee), Brian Long (University of Tennessee)\*

### 11:30 am TUESDAY

#### 17e - Ultra-High Permeability Mixed-Matrix Membranes as a Next-Generation Carbon Capture Technology for Post-Combustion

Sameh K Elsaidi (U.S. Department of Energy National Energy Technology Laboratory)\*, Surendar Venna (U.S. Department of Energy National Energy Technology Laboratory), Ali Sekizkardes (Battelle/ U.S. Department of Energy National Energy Technology Laboratory), Mona Mohamed (University of Pittsburgh), David Hopkinson (U.S. Department of Energy National Energy Technology Laboratory)

### 12:00 pm TUESDAY

#### 17f - Composite gas separation membranes from metal-induced ordered polymeric frameworks

Zhihua Qiao (Tianjin University), Song Zhao (Tianjin University), Menglong Sheng (Tianjin University), Jixiao Wang (Tianjin University), Zhi Wang (Tianjin University), Chongli Zhong (Tianjin University), Michael D Guiver (Tianjin

University)\*

### #18 Materials: Selective Polymeric and Mixed-Matrix Materials - Gas Separations ...pg.47

2:00 pm - 5:00 pm | Kings Garden 5

**Co-Chairs:** Ben Sundell (Aramco Services Company), Zach Smith (MIT)

### 2:00 pm TUESDAY

#### 18a - High temperature gas separation properties of sub-micron polybenzimidazole membranes

Melanie M Merrick (The University of Texas at Austin)\*, Benny Freeman (The University of Texas at Austin)

### 2:30 pm TUESDAY

#### 18b - Thermally Rearranged Semi-interpenetrating Polymer Network (TR-SIPN) Membranes for Olefin/Paraffin Separations

Young Moo Lee (Hanyang University)\*, Won Hee Lee (Hanyang University), Jong Geun Seong (Hanyang University), Ho Hyun Wang (Hanyang University), Sun Ju Moon (Hanyang University)

### 3:00 pm TUESDAY

#### 18c - Conformation-controlled molecular sieving effect for membrane-based propylene/propane separation

Yang Liu (Georgia Institute of Technology)\*, William Koros (Georgia Institute of Technology), Mohamed Eddaoudi (KAUST), Gongping Liu (Georgia Institute of Technology), Youssef Belmabkhout (KAUST), Zhijie Chen (KAUST)

### 3:30 pm TUESDAY

#### 18d - Mixed matrix materials containing soluble discrete metal-organic polyhedra in rubbery polyethers for CO<sub>2</sub>/gas separation

Haiqing Lin (The State University of New York at Buffalo)\*, Junyi Liu (The State University of New York at Buffalo), Cressa Fulong (The State University of New York at Buffalo), Tim Cook (The State University of New York at Buffalo)

**4:00 pm TUESDAY****18e - Accessing novel microporous polymers to enhance yield, stereochemical control, and membrane performance in the recovery of light hydrocarbons from natural gas**

John Lawrence (Aramco Services Company)\*

**4:30 pm TUESDAY****18f - Insight into the transport in polymeric and mixed matrix membranes via analysis of unique mixed gas diffusion coefficients**

Johannes Carolus (John) Jansen (National Research Council of Italy)\*, Alessio Fuoco (National Research Council of Italy), Marcello Monteleone (National Research Council of Italy), Elisa Esposito (National Research Council of Italy)

**#19 Processes: Process Scale-Up and Techno-Economic Assessment ...pg. 50**

**2:00 pm - 5:00 pm | Kings Garden 4**

**Co-Chairs:** JR Johnson (ExxonMobil), Bharat Bhut (Merck Pharmaceuticals), Ivy Huang (Membrane Technology and Research), Albert Kim (University of Hawaii)

**2:00 pm TUESDAY****19a - Minimizing the cost of membrane distillation**

Timothy V Bartholomew (Carnegie Mellon University)\*, Alexander V Dudchenko (Carnegie Mellon University), Nicholas Siefert (U.S. Department of Energy National Energy Technology Laboratory), Meagan S Mauter (Carnegie Mellon University)

**2:30 pm TUESDAY****19b - Process Optimization Using Perturbation Expansion Solutions for Membrane Gas Separation Modules**

Norfamila Che Mat (Universiti Malaysia Sarawak), Glenn Lipscomb (University of Toledo)\*

**3:00 pm TUESDAY****19c - Multi-physics Simulation of Hollow Fiber Vacuum Membrane Distillation Using OpenFoam**

Albert Kim (University of Hawaii), Ho Ji (Korea Research Institute Of Ships And Ocean Engineering), Deok-Soo Moon

(Korea Research Institute Of Ships And Ocean Engineering), Hyeon-Ju Kim (Korea Research Institute Of Ships And Ocean Engineering)

**3:30 pm TUESDAY****19d - Scale-up of Facilitated Transport Membrane Module for CO<sub>2</sub> Capture from Flue Gas**

Kai Chen (Ohio State University)\*, Witopo Salim (Ohio State University), Yang Han (Ohio State University), Dongzhu Wu (Ohio State University), Winston Ho (Ohio State University)

**4:00 pm TUESDAY****19e - Development of industrial scale polyvinylidene fluoride transfer membrane**

Marta E Bojarska (GVS Filter Technology)\*, Deb English (GVS Filter Technology), Gil Tavares (GVS Filter Technology)

**4:30 pm TUESDAY****19f - Low energy seawater desalination using multistage electrodialysis**

Gijs Doornbusch (Eindhoven University of Technology)\*, Michele Tedesco (Wetsus), Jan Post (Wetsus), Zandrie Borneman (Eindhoven University of Technology), Kitty Nijmeijer (Eindhoven University of Technology)

**#20 Processes: New Concepts in Hybrid Processes and Process Integration ...pg. 52**

**2:00 pm - 5:00 pm | Kings Garden 3**

**Co-Chairs:** Jia Wei Chew (Nanyang Technological University), Ed Sanders (Air Liquide-Global Markets & Technologies)

**2:00 pm TUESDAY****20a - Air Products Hybrid Membrane Adsorption**

Cory E Sanderson (Air Products and Chemicals)\*, Don Henry (Air Products and Chemicals)

**2:30 pm TUESDAY****20b - Hybrid Distillation and Facilitated Transport Membrane Processes for C3 Splitter Debottlenecking**

Kenneth Pennisi (Compact Membrane Systems), Christine Parrish (Compact Membrane Systems)\*, Sudip Majumdar (Compact Membrane Systems)



**3:00 pm TUESDAY****20c - Water Recovery via Forward Osmosis - Freeze Concentration**

Georgios Kolliopoulos (University of Toronto), Jeffrey Martin (University of Toronto), Chenbo Xu (University of Toronto), Vladimiro Papangelakis (University of Toronto)\*

**3:30 pm TUESDAY****20d - Leverage membrane technology in process intensification and new application design - from early stage design to technical scale implementation**

Peter Kreis (Evonik Technology & Infrastructure GmbH)\*, Kah Peng Lee (Evonik Fibres GmbH), Lars Peters (Evonik Fibres GmbH), Erik Hoving (Evonik Cooperation), Steven Pedersen (Evonik Canada Inc.), Kumar Abhinava (Evonik Cooperation)

**4:00 pm TUESDAY****20e - Carbon Capture utilizing Hybrid Membrane/Liquifaction**

David Hasse (Air Liquide)\*

**4:30 pm TUESDAY****20f - Membrane distillation hybridized with a thermoelectric heat pump for energy-efficient water treatment and space cooling**

Yong Zen Tan (Nanyang Technological University), Nick Guan Ping Chew (Nanyang Technological University), Wai Hoong Chow (Nanyang Technological University), Rong Wang (Nanyang Technological University), Jia Wei Chew (Nanyang Technological University)\*

## #21 Applications: Brine Treatment for Minimal and Zero Liquid Discharge ...pg 54

**2:00 pm - 5:00 pm | Ballroom 3**

**Co-Chairs:** Radisav Vidic (University of Pittsburgh), Kerri Hickenbottom (University of Arizona)

**2:00 pm TUESDAY****21a - Reduction of Brackish Water Desalination Brine Volume using Membrane Evaporation Coupled with Activated Sludge Aeration Waste Heat**

Drew W Johnson (The University of Texas at San Antonio)\*

**2:30 pm TUESDAY****21b - Smart High Recovery RO Boosts Recovery Rate to More Than 90% for Reuse Purposes**

Ronit Erlitzki (AdEdge Water Technologies)\*

**3:00 pm TUESDAY****21c - Membrane Distillation for Enhanced Water Recovery by Inland Brackish Water Desalination Plants**

Zhewei Zhang (University of Pittsburgh)\*, Radisav Vidic (University of Pittsburgh)

**3:30 pm TUESDAY****21d - Selective Separation of Industrial Relevant Metal Ions from High TDS Water using Wafer-Enhanced Electrodeionization (WE-EDI)**

Humeyra B Ulusoy Erol (University of Arkansas)\*, Christa Hestekin (University of Arkansas), Jamie Hestekin (University of Arkansas)

**4:00 pm TUESDAY****21e - Pilot Evaluation of Closed Circuit Reverse Osmosis (CCRO) for Treatment of RO Concentrate for Potable Reuse**

Han Gu (Orange County Water District)\*, Megan Plumlee (Orange County Water District), Mike Boyd (Desalitech), Ran Nadav (Desalitech), Michael Hwang (Jacobs), Jim Lozier (Jacobs)

**4:30 pm TUESDAY****21f - Brine Treatment for Minimal and ZLD**

Malynda Cappelle (The University of Texas at El Paso)\*, W. Shane Walker (The University of Texas at El Paso)

**#22 Materials: Innovations in Membrane Synthesis and Casting ...pg. 57****2:00 pm - 5:00 pm | Ballroom 4****Co-Chairs:** Rachel Dorin (Terapore Technologies), Ulrich Wiesner (Cornell University)**2:00 pm TUESDAY****22a - Novel Spirocyclic Polymers for Membrane-based Organic Solvent Separations**

Ronita Mathias (Georgia Institute of Technology)\*, Kirstie Thompson (Georgia Institute of Technology), Dhaval Bhandari (ExxonMobil), JR Johnson (ExxonMobil), Huaxing Zhou (ExxonMobil), M.G. Finn (Georgia Institute of Technology), Ryan Lively (Georgia Institute of Technology)

**2:30 pm TUESDAY****22b - 3D Printed fouling resistant composite membranes**

Davide Mattia (University of Bath)\*

**3:00 pm TUESDAY****22c - Next-Generation Membranes Using Thin-Film Lift Off**

Mackenzie Anderson (UCLA)\*, Brian McVerry (UCLA), Na He (UCLA), Eric Hoek (UCLA), Richard Kaner (UCLA)

**3:30 pm TUESDAY****22d - Interfacial Junctions Control Electrolyte Transport Through Charge-Patterned Membranes**

Feng Gao (University of Notre Dame), Bill Phillip (University of Notre Dame)\*

**4:00 pm TUESDAY****22e - Fabrication of Inside-Out Isoporous Hollow Fiber Membranes via Spinning and Coating Methods**

Kirti Sankhala (Helmholtz-Zentrum Geesthacht, Geesthacht)\*, Joachim Koll (Helmholtz-Zentrum Geesthacht, Geesthacht), Maryam Radjabian (Helmholtz-Zentrum Geesthacht, Geesthacht), Clarissa Abetz (Helmholtz-Zentrum Geesthacht, Geesthacht), Volker Abetz (Helmholtz-Zentrum Geesthacht, Geesthacht)

**4:30 pm TUESDAY****22f - Empirical evidence suggests that polyamide film formation during interfacial polymerization in thin film composite (TFC) membranes is not self-limiting**

Kasia Grzebyk (University of North Carolina at Chapel Hill)\*, Orlando Coronell (University of North Carolina at Chapel Hill)

**Plenary Session 3****7:45 am - 9:00 pm | Ballroom 1****Dr. Rachel Segalman**

University of California, Santa Barbara

**Polymeric Ionic Liquids: A New Platform for Materials and Energy****#23 Awards Session (Student Fellowship & Young Membrane Scientist Awards) ...pg. 59****9:30 am - 12:30 pm | Kings Garden 4****Chair:** Caleb Funk (The Dow Chemical Company)**9:30 am WEDNESDAY****23a - Creation of well-defined "mid-sized" micropores in carbon molecular sieve membranes for organic solvent separations**

Yao Ma (Georgia Institute of Technology)\*, Dhaval Bhandari (ExxonMobil), JR Johnson (ExxonMobil), Ryan Lively (Georgia Institute of Technology)

**10:00 am WEDNESDAY****23b - PoreDesigner for computational optimization of channel proteins and porous organic cages for highly selective membrane-based separations**

Ratul Chowdhury (Penn State University)\*

**10:30 am WEDNESDAY****23c - Crack-free, large-area, single-layer graphene membranes with a record performance in gas mixture separation**

Shiqi Huang (L'Ecole polytechnique fédérale de Lausanne)\*, Kumar Varoon Agrawal (L'Ecole polytechnique fédérale de Lausanne), Jing Zhao (L'Ecole polytechnique fédérale de Lausanne)

**11:00 am WEDNESDAY****23d - Unprecedented CO<sub>2</sub>/H<sub>2</sub> Selectivity and CO<sub>2</sub> Permeance Demonstrated in Facilitated Transport Membranes with Tunable Amine-CO<sub>2</sub> Chemistry**

Yang Han (Ohio State University)\*, Winston Ho (Ohio State University)

**11:30 am WEDNESDAY****23e - Engineering the Nanochannels in Reduced Graphene Oxide Membrane for Dye Desalination**

Liang Huang (The State University of New York at Buffalo)\*, Haiqing Lin (The State University of New York at Buffalo)

**12:00 pm WEDNESDAY****23f - Impact of module design on heat transfer and Nusselt correlation selection in membrane distillation**

Alexander V Dudchenko (Carnegie Mellon University)\*, Meagan S Mauter (Carnegie Mellon University)

**#24 Applications: Cell and Protein Purification, Harvesting, and Processing ...pg. 61****9:30 am - 12:30 pm | Kings Garden 3****Co-Chairs:** Merlin Bruening (University of Notre Dame), Jessica Molek (GlaxoSmithKline), Prity Bengani-Lutz (Repligen Corporation), Sen Xu (Merck Pharmaceuticals)**9:30 am WEDNESDAY****24a - Experimental and Theoretical Investigations of the Loss of Protein Sieving Due to Fouling of ATF Microfilters**

Alex Apostolidis (Amgen)\*, Glen Bolton (Amgen)

**10:00 am WEDNESDAY****24b - pH and Excipient Partitioning in Ultrafiltration/Diafiltration Processes for Formulation of High Concentration Monoclonal Antibody (mAb) Products**

Parinaz Emami (Penn State University)\*, Youngbin Baek (Penn State University), Nripen Singh (Bristol-Myers Squibb), Andrew Zydney (Penn State University)

**10:30 am WEDNESDAY****24c - Effect of membranes molecular weight cut-off on peptides migration and selectivity during electrodialysis with filtration membranes**

Sabita Kadel (Laval University)\*, Jacinthe Thibodeau (Laval University), Carole Laine (Amer-Sil), Laurent Bazinet (Laval University)

**11:00 am WEDNESDAY****24d - Scale down depth filtration case study using Pall Supracap™ 50 to predict large scale STAX™ capacity and product quality**

Patricia Rose (Merck Pharmaceuticals)\*, Jennifer Pollard (Merck Pharmaceuticals)

**11:30 am WEDNESDAY****24e - Unraveling the Plugging Mechanisms during a Combined Tangential-flow and Depth Filtration Process**

Xianghong Qian (University of Arkansas)\*, Da Zhang (University of Arkansas), Daniel Strauss (Asahi Kasei), Parag Patel (Asahi Kasei), Ranil Wickramasinghe (University of Arkansas)

**12:00 pm WEDNESDAY****24f - Functionalized Microporous Membranes for Protein Capture and Analysis**

Joshua Berwanger (University of Notre Dame)\*, Merlin Bruening (University of Notre Dame), Liu Yang (University of Notre Dame), Hui Yin Tan (University of Notre Dame), Weijing Liu (University of Notre Dame)

## #25 Processes: Innovations in Microfiltration and Ultrafiltration... pg. 64

**9:30 am - 12:30 pm | Ballroom 3**

**Co-Chairs:** Beth Goodrich (MilliporeSigma), Vlad Tarabara (Michigan State University)

**9:30 am WEDNESDAY****25a - A systematic approach to remove bottlenecks in high concentration UF/DF for subcutaneous application of biological drug substances**

Hasin M Feroz (Bristol-Myers Squibb)\*, Dongyoun Jang (Bristol-Myers Squibb), Jessica Hung (Bristol-Myers Squibb),

Yan Chen (Bristol-Myers Squibb), Erinc Sahin (Bristol-Myers Squibb), Andrew Zydney (Penn State University), Melissa Holstein (Bristol-Myers Squibb), Sanchayita Ghose (Bristol-Myers Squibb)

**10:00 am WEDNESDAY****25b - Continuous Diafiltration for cGMP Biomanufacturing**

Akshat Gupta (MilliporeSigma)\*, Beth Goodrich (MilliporeSigma), Herb Lutz (MilliporeSigma)

**10:30 am WEDNESDAY****25c - Understanding the role that patterning plays on membrane biofouling by visualization using light imaging and simulation**

Anna Malakian (Clemson University)\*, Bowen Ling (Stanford University), Ilenia Battiato (Stanford University), Scott Husson (Clemson University)

**11:00 am WEDNESDAY****25d - Treating Poultry Processing Wastewaters by Combined Electrocoagulation and Ultrafiltration**

Ranil Wickramasinghe (University of Arkansas)\*, Kamyar Sardari (University of Arkansas)

**11:30 am WEDNESDAY****25e - Mass transfer assisted TIPS process to precisely tailor the hollow fiber membrane surface and sublayer structures**

Hideto Matsuyama (Kobe University)\*, Chuanjie Fang (Kobe University), Saeid Rajabzadeh (Kobe University)

**12:00 pm WEDNESDAY****25f - Organic solvent resistant membranes obtain by using non-toxic solvents**

Stefan Chisca (King Abdullah University of Science and Technology)\*, Gheorghe Falca (King Abdullah University of Science and Technology), Tommaso Marchesi (University of Bologna), Valentina Elena Musteata (King Abdullah University of Science and Technology), Suzana Nunes (King Abdullah University of Science and Technology)

## #26 Materials: Bio-inspired and Biomimetic Materials ...pg. 67

9:30 am - 12:30 pm | Ballroom 4

**Co-Chairs:** Chunlong Chen (Pacific Northwest National Laboratory), Yair Kaufman (Ben Gurion University of the Negev), DB Bhattacharyya (University of Kentucky)

9:30 am WEDNESDAY

### 26a - Artificial Water Channels - toward biomimetic membranes for desalination

Mihail Barboiu (Institut Europeen des Membranes)\*

10:00 am WEDNESDAY

### 26b - Self-Assembly of Long-Lasting Lipid Bilayers and the Effect of Temperature of their Ion Rejection

Yair Kaufman (Ben Gurion University of the Negev)\*, Shiju Abraham (Ben Gurion University of the Negev), Tabea Heckenthaler (Ben Gurion University of the Negev), Yacov Morgenstern (Ben Gurion University of the Negev)

10:30 am WEDNESDAY

### 26c - Peptoid-based membrane-mimetic 2D nanomaterials with incorporated natural and synthetic channels

Chunlong Chen (Pacific Northwest National Laboratory)\*

11:00 am WEDNESDAY

### 26d - Scalable High-Performance Membranes with High Density Channel Protein-Polymer Nanosheets

Yu-Ming Tu (Penn State University)\*, Woochul Song (Penn State University), Tingwei Ren (Penn State University), Yuexiao Shen (UC Berkeley), Ratul Chowdhury (Penn State University), Prasangi Rajapaksha (University of Kentucky), Drew Carson (Penn State University), Yuxuan Dai (Penn State University), Arwa Mukthar (Penn State University), Miaoci Zhang (Penn State University), Alina Thokkadam (Rutgers University), DB Bhattacharyya (University of Kentucky), Bill Phillip (University of Notre Dame), Robert Hickey (Penn State University), Yinai Wei (University of Kentucky), Manish Kumar (Penn State University)

11:30 am WEDNESDAY

### 26e - Fabrication of aquaporin-based biomimetic membrane for seawater desalination

Ye Li (Nanyang Technological University)\*, Rong Wang (Nanyang Technological University)

12:00 pm WEDNESDAY

### 26f - Biomimetic channel membranes: can they realize their full potential upon scale-up?

Viatcheslav Freger (Technion - IIT)\*

## #27 Materials: Advances in Membrane and Materials Characterization ...pg. 69

9:30 am - 12:30 pm | Kings Garden 5

**Co-Chairs:** Weiyi Li (School of Environment Science and Engineering), Maria-Chiara Ferrari (The University of Edinburgh), Chuyang Tang (University of New South Wales)

9:30 am WEDNESDAY

### 27a - Surface Nano-structuring with Hydrophilic Polymer Brush Layers for Membrane Performance Tailoring and Optimization

Yian Chen (UCLA)\*, Soomin Kim (UCLA), Anditya Rahardianto (UCLA), Yoram Cohen (UCLA)

10:00 am WEDNESDAY

### 27b - Roughness in Polyamide RO Membranes: Its Formation Mechanism, Control, and Implications

Chuyang Y Tang (University of Hong Kong / University of New South Wales)\*

10:30 am WEDNESDAY

### 27c - Mechanism of chlorine attack on polyamide membranes studied by EIS

Mikhail Stolov (Technion - IIT), Viatcheslav Freger (Technion - IIT)\*

**11:00 am WEDNESDAY****27d - Physicochemical and electrochemical characterization of cation-exchange membranes modified with polyethyleneimine for elucidating enhanced monovalent permselectivity of electrodialysis**

Wenbin Jiang (New Mexico State University)\*, Lu Lin (New Mexico State University), Xuesong Xu (New Mexico State University), Pei Xu (New Mexico State University)

**11:30 am WEDNESDAY****27e - Unraveling the Film-Formation Kinetics during Interfacial Polymerization via Low Coherence Interferometry**

Xin Liu (Southern University of Science and Technology)\*, Weiyi Li (Southern University of Science and Technology), Zhuo Li (Southern University of Science and Technology), Anthony Fane (Singapore Membrane Technology Centre), Baolin Deng (Southern University of Science and Technology)

**12:00 pm WEDNESDAY****27f - Operando Membrane Spectroscopy for Elucidating Transport Mechanisms in Membranes**

Casey O'Brien (University of Notre Dame)\*

## #28 Materials: Bio-inspired and Biomimetic Materials ...pg. 71

2:00 pm - 5:00 pm | Ballroom 4

**Co-Chairs:** Chunlong Chen (Pacific Northwest National Laboratory), Yair Kaufman (Ben Gurion University of the Negev), DB Bhattacharyya (University of Kentucky)

**2:00 pm WEDNESDAY****28a - Biofouling resistant membranes for wound healing**

Antoine Venault (Chung Yuan Christian University)\*, Hao-Tung Lin (Chung Yuan Christian University), Yung Chang (Chung Yuan Christian University)

**2:30 pm WEDNESDAY****28b - How pore hydrophilicity influences water permeability?**

Mingjie Wei (Nanjing Tech University)\*, Fang Xu (Nanjing Tech University), Yong Wang (Nanjing Tech University)

**3:00 pm WEDNESDAY****28c - Biomimetic membrane systems utilizing electro-dynamic interfaces**

Bruce Hinds (University of Washington)\*

**3:30 pm WEDNESDAY****28d - Responsiveness and function of DNA-gated membranes**

Beñat Olave (Polymat, University of the Basque Country), Iliane Rafaniello (Polymat, University of the Basque Country), Thomas Schäfer (Polymat, University of the Basque Country)\*

**4:00 pm WEDNESDAY****28e - Nature-inspired Coating-free Membranes for Desalination**

Himanshu Mishra (King Abdullah University of Science and Technology)\*, Ratul Das (King Abdullah University of Science and Technology), Sankara Arunachalam (King Abdullah University of Science and Technology), Zain Ahmad (King Abdullah University of Science and Technology), Edelberto Manalastas (King Abdullah University of Science and Technology)

**4:30 pm WEDNESDAY****28f - Carbon nanotube porins as model biomimetic membrane nanopores**

Aleksandr Noy (Lawrence Livermore National Laboratory)\*

## #29 Materials: Advances in Membrane and Materials Characterization ...pg. 74

2:00 pm - 5:00 pm | Kings Garden 5

**Co-Chairs:** Weiyi Li (School of Environment Science and Engineering), Maria-Chiara Ferrari (The University of Edinburgh), Chuyang Tang (University of New South Wales)

2:00 pm WEDNESDAY

### 29a - A novel method to distinguish between crystal and defect transport in zeolite membranes

David Carter (University of Ottawa), Shaaime Al Akwa (University of Ottawa), Boguslaw Kruczek (University of Ottawa)\*, Handan Tezel (University of Ottawa)

2:30 pm WEDNESDAY

### 29b - Study on antifouling behaviors of GO modified nanocomposite membranes through QCMD and surface energetics analysis

Amin Karkooti (University of Alberta), Neda Nazemifard (University of Alberta), Mohtada Sadrzadeh (University of Alberta)\*

3:00 pm WEDNESDAY

### 29c - 3D characterization of polyamide reverse osmosis membranes

Tyler E Culp (Penn State University)\*, Manish Kumar (Penn State University), Enrique Gomez (Penn State University)

3:30 pm WEDNESDAY

### 29d - Selective Ion Transport Properties of Membrane Materials

Anita Hill (Commonwealth Scientific and Industrial Research Organisation)\*, Aaron Thornton (Commonwealth Scientific and Industrial Research Organisation), Cara Doherty (Commonwealth Scientific and Industrial Research Organisation)

4:00 pm WEDNESDAY

### 29e - Membrane-based oil-gas separation for dissolved gas-in-oil extraction: gas transport properties of ceramic supported Teflon membranes

Liang-Chih Ma (Arizona State University)\*, Chuan Chen (Global Energy Interconnection Research Institute Co., Ltd.), Jerry Lin (Arizona State University)

4:30 pm WEDNESDAY

### 29f - Porous support of TFC membranes: Does it truly have negligible resistance?

Masoud Aghajani (University of Colorado Boulder)\*, Alan R. Greenberg (University of Colorado Boulder), Yifu Ding (University of Colorado Boulder)

## #30 Processes: Fundamentals of Predicting and Preventing Membrane Fouling ...pg. 76

2:00 pm - 5:00 pm | Kings Garden 4

**Co-Chairs:** Manish Kumar (Penn State University), Davide Mattia (University of Bath), Saifur Rahaman (Concordia University)

2:00 pm WEDNESDAY

### 30a - Numerical and experimental studies on the deposition of sticky particles near a membrane surface

Seon Yeop Jung (Seoul National University)\*, Kyung Hyun Ahn (Seoul National University)

2:30 pm WEDNESDAY

### 30b - Characterization of the Striping Phenomenon during Membrane Fouling via Optical Coherence Tomography

Weiyi Li (Southern University of Science and Technology)\*, Xin Liu (Southern University of Science and Technology), Anthony Fane (Singapore Membrane Technology Centre)

3:00 pm WEDNESDAY

### 30c - A closer look at biofouling: time-lapse optical microscopy of biofilm formation in wastewater reuse

Emily W Tow (Olin College)\*, Behzad Rad (Lawrence Berkeley National Laboratory), Robert Kostecki (Lawrence Berkeley National Laboratory)

**3:30 pm WEDNESDAY****30d - Improved graphene oxide membrane increases membrane distillation desalination of RO concentrate**

Samuel Olatunji (Texas A&M University-Kingsville),  
Lucy M Camacho (Texas A&M University-Kingsville)\*

**4:00 pm WEDNESDAY****30e - Automated real-time membrane biofouling assessment using microbial enzyme activity**

Babar K Khan (King Abdullah University of Science and Technology)\*, Luca Fortunato (King Abdullah University of Science and Technology), TorOve Leiknes (King Abdullah University of Science and Technology)

**4:30 pm WEDNESDAY****30f - Interactions between extracellular polymeric substances and zwitterionic hydrogels as a designing tool for antifouling surfaces**

Angelin Ida Vedhamanickam (Ben-Gurion University of the Negev)\*, Nir Goldberg (Ben-Gurion University of the Negev), Ronit Bitton (Ben-Gurion University of the Negev), Moshe Herzberg (Ben-Gurion University of the Negev)

**#31 Applications: Purification of Non-Protein Biologics ...pg. 79**

**2:00 pm - 5:00 pm | Kings Garden 3**

**Co-Chairs:** James McGrath (University of Rochester),  
Onur Kas (MilliporeSigma)

**2:00 pm WEDNESDAY****31a - Optimizing Microfluidic Nanoparticle Capture from Biofluids on Ultrathin Silicon Nanomembranes: A Computational and Experimental Analysis of Tangential Flow Analyte Capture (TFAC)**

Kilean Lucas (University of Rochester)\*, Danial Ahmad (University of Rochester), Mehdi (Aslan) Dehghani (Rochester Institute of Technology), Thomas Gaborski (Rochester Institute of Technology), Richard Waugh (University of Rochester), James McGrath (University of Rochester)

**2:30 pm WEDNESDAY****31b - Development and scale-up of laterally-fed membrane chromatography for the purification of therapeutic viruses**

Karina Kawka (McMaster University)\*, Pedram Madadkar (McMaster University), Shabnam Shoaebargh (McMaster University), Natasha Kazhdan (McMaster University), Maria Fe C. Medina (McMaster University), Brian Lichty (McMaster University), Raja Ghosh (McMaster University), David Latulippe (McMaster University)

**3:00 pm WEDNESDAY****31c - Characterization of EV Secretion at Single Cell Resolution**

Gerardo Mauleon Ramos (University of Chicago)\*, Kilean Lucas (University of Rochester), Vladimir Riazanski (University of Chicago), James McGrath (University of Rochester), Deborah Nelson (University of Chicago)

**3:30 pm WEDNESDAY****31d - Charge, size distribution and hydrophobicity of viruses: Effect of the virus purification method**

Hang Shi (Michigan State University), Vlad Tarabara (Michigan State University)\*

**4:00 pm WEDNESDAY****31e - Risk Mitigation Strategies for the use of polymeric consumables for manufacturing of Anti-Sense Oligonucleotides**

Anuradha Vaidya (Biogen), Bill Scott\* (Biogen),  
Dave Kolwyck (Biogen)

**4:30 pm WEDNESDAY****31f - Use of Nanosphere Self-Assembly to Pattern Nanoporous Membranes for the Study of Extracellular Vesicles**

Marcela Mireles (University of Rochester)\*, Cody Soule (Rochester Institute of Technology), Mehdi Dehghani (Rochester Institute of Technology), Thomas Gaborski (Rochester Institute of Technology)



**#32 Applications: Fuel Cells and Batteries ...pg. 81****2:00 pm - 5:00 pm | Ballroom 3****Co-Chairs:** Michael Guiver (Tianjin University), Mike Hickner (Penn State University), Peter Pintauro (Vanderbilt University)**2:00 pm WEDNESDAY****32a - A Holistic Approach to Explore Interfacially Confined Ionomers Designed for Energy Conversion Device**

Shudipto K Dishari (University of Nebraska-Lincoln)\*

**2:30 pm WEDNESDAY****32b - Anion Conducting Membranes Based on Poly(norbornene): High Conductivity, Chemical Stability and Fuel Cell Performance >2.5 W/cm<sup>2</sup>**

Mrinmay Mandal (Georgia Institute of Technology)\*, Garrett Huang (Georgia Institute of Technology), Wanting Chen (Georgia Institute of Technology), Paul A Kohl (Georgia Institute of Technology)

**3:00 pm WEDNESDAY****32c - High Temperature Fuel Cells with Ion-Pair Membranes and Phosphonated Ionomers**

Michael R Hibbs (Sandia National Laboratories)\*, Cy Fujimoto (Sandia National Laboratories), Ehren Baca (Sandia National Laboratories), Albert Lee (Los Alamos National Laboratory), Yu Seung Kim (Los Alamos National Laboratory)

**3:30 pm WEDNESDAY****32d - High temperature, anhydrous proton conducting membranes and micropatterned bipolar membranes for electrochemical energy conversion and storage technologies**

Christopher G Arges (Louisiana State University)\*

**4:00 pm WEDNESDAY****32e - Membrane through-plane alignment of ion-conducting channels**

Xin Liu (Tianjin University), Yi Li (Tianjin University), Jiandang Xue (Tianjin University), Weikang Zhu (Tianjin University), Junfeng Zhang (Tianjin University), Yan Yin (Tianjin University), Michael D Guiver (Tianjin University)\*

**4:30 pm WEDNESDAY****32f - Novel sulfonated aromatic polymer membranes for breaking the proton selectivity-conductivity trade-off limitation in vanadium redox flow battery**

Tongshuai Wang (University of Illinois, Chicago), JunYoung Han (Rensselaer Polytechnic Institute), Kihyun Kim (Rensselaer Polytechnic Institute), Andreas Muenchinger (Max-Planck-Institute for Solid State Research), Klaus-Dieter Kreuer (Max-Planck-Institute for Solid State Research), Chulsung Bae (Rensselaer Polytechnic Institute), Sangil Kim (University of Illinois, Chicago)\*

## Poster Presentations

Presenting authors are indicated by an asterisk\*. See the most up-to-date version of the program with abstracts at [nams2019.org](https://nams2019.org) or via the **Attendify (NAMS 2019)** app.

### SESSION A - Innovation in Bio-Inspired and Bio-Applied Membranes ...pg. 84

- A1 High-Capacity Multimodal Anion-Exchange Membranes for Purification of Biologics**, Joshua Osuofa (Clemson University)\*; Scott Husson (Clemson University)
- A2 High throughput screening of ultra-filtration membranes with mixed dextrans in 96 well plate**, Masha Khazan (Pall Corporation)\*; James Hathcock (Pall Corporation); Jian Qiu (Pall Corporation)
- A3 Impacts of Bio-inspired Zwitterionic Membranes for Health Care Applications**, Yung Chang (R&D Center for Membrane Technology, CYCU)\*
- A4 Enhanced Membranes for Biogas Upgrading**, Ning Shangguan (Compact Membrane Systems)\*; Sudip Majumdar (Compact Membrane Systems); Kenneth Pennisi (Compact Membrane Systems)
- A5 Monitoring of Membrane Fouling by the Zeta Potential**, Thomas Luxbacher (Anton Paar GmbH)\*; Hermina Buksek (University of Maribor); Irena Petrinic (University of Maribor); Elisa Innocenti (GSK Vaccines S.r.l.); Krzysztof Trzaskus (Aquaporin A/S); Maria Salud Camilleri-Rumbai (Aquaporin A/S)
- A6 Tangential flow microfluidics for the capture and release of nanoparticles and extracellular vesicles on conventional and ultrathin membranes**, Mehdi Dehghani (Rochester Institute of Technology)\*; Kilean Lucas (University of Rochester); James McGrath (University of Rochester); Thomas Gaborski (Rochester Institute of Technology)
- A7 Low-cost ultrathin porous polymeric membranes with precise control over pore size and thickness gradient for investigation of leukocyte transmigration through barrier models**, Shayan Gholizadeh (Rochester Institute of Technology)\*; Alec Salminen (University of Rochester); Zahra Allahyari (Rochester Institute of Technology); Robert Carter (Rochester Institute of Technology); Henry Chung (Rochester Institute of Technology); Marcela Mireles (University of Rochester); Thomas Gaborski (Rochester Institute of Technology)
- A8 Application of Novel Multimodal Anion-exchange Membrane Chromatography Columns in a Two-step mAb Purification Scheme - Aggregates and HCP Removal**, Daniel Henn (Purilogs, LLC)\*; Anna Forsyth (Purilogs, LLC); Graham Temples (Purilogs, LLC); Jinxiang Zhou (Purilogs, LLC); Scott Husson (Clemson University)
- A9 Effect of Nanomembrane Orientation and Flow Modality on Benchtop Urea Clearance**, Sam Walker (The State University of New York at Buffalo)\*; Kayli Hill (University of Rochester); Alec Salminen (University of Rochester); Dean G Johnson (University of Rochester)
- A10 Feed Spacer Modification for Listeria Control in Dairy Processing**, Mainara Costa Teixeira (The University of Alabama)\*; Preston Richier (The University of Alabama); Jake Colburn (The University of Alabama); Shelby Brooks (The University of Alabama); Will Baker (The University of Alabama); Thomas Hendrich (The University of Alabama); Ryan Summers (The University of Alabama); Stephen Ritchie (The University of Alabama)
- A11 Critical Flux of Ultrathin Silicon Membranes in Tangential Flow Filtration of Protein Solutions**, Danial Ahmad (University of Rochester)\*; Kilean Lucas (University of Rochester); Mehdi (Aslan) Dehghani (Rochester Institute of Technology); Thomas Gaborski (Rochester Institute of Technology); James McGrath (University of Rochester)

- A12 Grafting Zwitterionic Polymer and Poly (amino acid) on Polyamide Membranes: "Defending and Attacking" Strategies for Biofouling Control**, Wen Ma (Concordia University)\*; Liqing Yang (Concordia University); Saifur Rahaman (Concordia University)
- A13 Monitoring of biological fluids with extraction membranes**, Pinar Cay-Durgun (Arizona State University); Tianmiao Lai (Arizona State University); Nai-Yuan Liu (Arizona State University); Mark Sprowls (Arizona State University); Stewart Mann (Arizona State University); Leslie Thomas (Mayo Clinic in Arizona); Erica Forzani (Arizona State University); Mary Laura Lind (Arizona State University)\*
- A14 Fine-Tuned Biohybrid Polymeric Particles Mimicking Biological Compartmentalization Prepared by Membrane Emulsification**, Emma Piacentini (National Research Council of Italy, Institute on Membrane Technology, CNR-ITM); Lidietta Giorno (National Research Council of Italy - Institute on Membrane Technology)\*
- A15 Bio-inspired immobilization of casein-coated silver nanoparticles on cellulose acetate ultrafiltration membranes: from laboratory to scale-up**, Xiaobo Dong (University of Kentucky)\*; Halle Shannon (University of Kentucky); Tequila Harris (Georgia Institute of Technology); Isabel Escobar (University of Kentucky)
- A16 Surface-Specific Thermoresponsive Coating of Membranes**, Marcela Mireles (University of Rochester)\*; Cody Soule (Rochester Institute of Technology); Luis Delgadillo (University of Rochester); Thomas Gaborski (Rochester Institute of Technology)
- A17 Pervaporation Separation of n-Butanol from Aqueous Solutions Using PDMS/Lignin Mixed Matrix Membranes**, Ali Zamani (University of Ottawa); Handan Tezel (University of Ottawa)\*; Jules Thibault (University of Ottawa)
- A18 Rapid and Selective Water Permeation Across Biomimetic Membranes Through Artificial Water Channel Aggregates**, Woonchul Song (Penn State University)\*; Ratul Chowdhury (Penn State University); Himanshu Joshi (University of Illinois at Urbana-Champaign); Joseph S. Najem (The University of Tennessee); Yue-xiao Shen (UC Berkeley); Chao Lang (Penn State University); Stephen Sarles (University of Tennessee); Jun-li Hou (Fudan University); Aleksei Aksimentiev (University of Illinois at Urbana-Champaign); Manish Kumar (Penn State University)
- A19 Can porous membranes be engineered to induce physiologically relevant cell-substrate interactions?**, Zahra Allahyari (Rochester Institute of Technology)\*; Stephanie Casillo (Rochester Institute of Technology); Shayan Gholizadeh (Rochester Institute of Technology); Henry Chung (Rochester Institute of Technology); Thomas Gaborski (Rochester Institute of Technology)
- A20 High Productivity Harvest - Intensify Harvest and Displace Depth Filtration in Fed-Batch Cell Culture**, Shashi Kudugunti (Repligen Corporation)\*; Jyoti Amatya (Repligen Corporation); Jamie Peyser (Repligen Corporation)
- A21 Membrane Filtration of Flexible Particles: Rejection of Single Stranded DNA**, Hossein Nouri Alavijeh (Clarkson University)\*; Ruth E. Baltus (Clarkson University)

## SESSION B - Innovation in Membrane Materials, Synthesis, and Characterization: Gases ...pg. 90

- B1 Covalently modified graphene oxide incorporated in PIM-1 mixed matrix thin film composite membranes for gas separation**, Elvin Aliyev (Helmholtz-Zentrum Geesthacht)\*; Volkan Filiz (Helmholtz-Zentrum Geesthacht); Sergey Shishatskiy (Helmholtz-Zentrum Geesthacht)
- B2 Tunable Interlayer Channels in Graphene Oxide Membranes for Molecular Separations**, Shaofei Wang (King Abdullah University of Science and Technology)\*; Zhongyi Jiang (Tianjin University); Michael D Guiver (Tianjin University); Suzana Nunes (King Abdullah University of Science and Technology)

- B3 Nanoporous two-dimensional nanosheets and their self-assembled gas-sieving membranes**, Kumar Varoon Agrawal (École polytechnique fédérale de Lausanne)\*; Mostapha Dakhchoune (École polytechnique fédérale de Lausanne); Luis Francisco Villalobos (École polytechnique fédérale de Lausanne)
- B4 Thermally Rearranged Semi-interpenetrating Polymer Networks (TR-SIPNs) for Olefin/Paraffin Separation Applications**, Won Hee Lee (Hanyang University)\*; Young Moo Lee (Hanyang University); Jong Geun Seong (Hanyang University); Ho Hyun Wang (Hanyang University); Sun Ju Moon (Hanyang University)
- B5 Design of new polymeric materials for membrane gas-separation based on norbornenes bearing hydrocarbonic groups**, Alyona Wozniak (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences); Evgeniya Bermesheva (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences); Danila Bakhtin (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences); Ilya Borisov (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences); Alexey Volkov (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences); Eugene Finkelshtein (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences); Maxim Bermeshev (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences)\*
- B6 Cake layer characterization in Activated Sludge Membrane Bioreactor: Real-time analysis**, Luca Fortunato (King Abdullah University of Science and Technology)\*; TorOve Leiknes (King Abdullah University of Science and Technology)
- B7 Facilitated Transport Membrane for CO<sub>2</sub> Capture from Flue Gas: Module Fabrication and Scale-Up**, Kai Chen (Ohio State University)\*; Witopo Salim (Ohio State University); Yang Han (Ohio State University); Dongzhu Wu (Ohio State University); Winston Ho (Ohio State University)
- B8 Interfacial phenomenon-driven hierarchical structuring of hard templated asymmetric ultrathin carbon molecular sieves films**, Megha Sharma (Lehigh University)\*; Mark Snyder (Lehigh University)
- B9 Layer-by-Layer Assembled Metal Organic Framework Nanosheets with Polymer**, Christy Koerner (U.S. Department of Energy National Energy Technology Laboratory)\*; Fangming Xiang (U.S. Department of Energy National Energy Technology Laboratory); Eric Popczun (U.S. Department of Energy National Energy Technology Laboratory); David Hopkinson (U.S. Department of Energy National Energy Technology Laboratory)
- B10 Highly oxygen-rich rubbery polymers for membrane CO<sub>2</sub>/CH<sub>4</sub> separation**, Krysta Clark (The State University of New York at Buffalo)\*; Junyi Liu (Air Liquide. Inc); Gengyi Zhang (The State University of New York at Buffalo); Haiqing Lin (The State University of New York at Buffalo)
- B11 Adsorptive and Destructive Mixed Matrix Membranes for Chemical Protection**, Yufeng Song (New Jersey Institute of Technology)\*; John Chau (New Jersey Institute of Technology); Kamallesh K Sirkar (New Jersey Institute of Technology); Gregory Peterson (U.S. Army Edgewood Chemical Biological Center); Uwe Beuscher (W.L. Gore & Associates Inc.)
- B12 Maximizing Ether Oxygen Content in Polymers for Membrane CO<sub>2</sub> Removal from Natural Gas**, Junyi Liu (American Air Liquide. Inc)\*; Gengyi Zhang (The State University of New York at Buffalo); Krysta Clark (The State University of New York at Buffalo); Haiqing Lin (The State University of New York at Buffalo)
- B13 Novel CO<sub>2</sub> gas separation membranes prepared by chemical modification of highly permeable polymers**, Eugenia Mariana Sandru (SINTEF AS); Arpenik Kroyan (Norwegian University of Science and Technology); Nebosja Simic (Norwegian University of Science and Technology); Jing Deng (Norwegian University of Science and Technology); Liyuan Deng (Norwegian University of Science and Technology); Marius Sandru (SINTEF AS)\*
- B14 Intrinsically Microporous Pentiptycene-based Polymers for Enhanced Gas Separation Performance and Physical Aging Resistance**, Tanner Corrado (University of Notre Dame)\*; Ruilan Guo (University of Notre Dame)
- B15 Structural Designs of Cross-linked Polymer Network and Ionic Liquids for Ion Gel Gas Separation Membranes**, Victor A Kusuma (U.S. Department of Energy National Energy Technology Laboratory)\*; James S Baker (U.S. Department of Energy National Energy Technology Laboratory); Megan Macala (U.S. Department of Energy National Energy Technology Laboratory); Samir Budhathoki (U.S. Department of Energy National Energy Technology Laboratory); David Hopkinson (U.S. Department of Energy National Energy Technology Laboratory)

- B16 Scalable hydrogen-bonded polyimide/metal-organic framework hybrid membranes for ultra-fast separations of multiple gas pairs**, Canghai Ma (Lawrence Berkeley National Laboratory)\*; Jeffrey Urban (Lawrence Berkeley National Laboratory)
- B17 Performance Testing of Polyphosphazene-Based Membranes for Post-combustion Carbon Capture with Humidified Gas**, Zi Tong (U.S. Department of Energy National Energy Technology Laboratory)\*; David Hopkinson (U.S. Department of Energy National Energy Technology Laboratory); Victor A Kusuma (U.S. Department of Energy National Energy Technology Laboratory)
- B18 Systematic Optimization of MOF-based Mixed-Matrix Membranes: Surface Functionalization, Particle Size, and Loading**, Patrick Muldoon (Oak Ridge Institute for Science and Education)\*
- ~~**B19 Membrane heat exchanger for novel heat recovery in post-combustion carbon capture**~~, Shuaifei Zhao (Dalian Maritime University)\*; Shuiping Yan (Huazhong Agricultural University); Qiufang Cui (Huazhong Agricultural University)
- B20 CANAL Ladder Polymers for Membrane Gas Separation**, Holden W. H. Lai (Stanford University)\*; Francesco Benedetti (University of Bologna); Zach Smith (MIT); Yan Xia (Stanford University)
- B21 Fabrication of CO<sub>2</sub> selective miscible polyimide blend membranes for gas separation applications**, Chamaal Karunaweera (The University of Texas at Dallas)\*; John Ferraris (The University of Texas at Dallas); Kenneth Balkus, Jr. (The University of Texas at Dallas); Inga Musselman (The University of Texas at Dallas); Samitha Panangala (The University of Texas at Dallas); Shahed Haghiri (The University of Texas at Dallas)
- B22 On development of constant-volume permeation system for monitoring upstream pressure decay**, Haoyu Wu (University of Ottawa)\*; Jules Thibault (University of Ottawa); Boguslaw Kruczek (University of Ottawa)
- B23 Two-dimensional-material mixed-matrix membranes for gas separation**, Gongping Liu (Nanjing Technical University)\*
- B24 Synthesis of crosslinked polyether-based membranes for gas separations**, Malgorzata Chwatko (The University of Texas at Austin)\*; Christina Rodriguez (The University of Texas at Austin); Caitlin Bentley (The University of Texas at Austin); Nathaniel Lynd (The University of Texas at Austin); Benny Freeman (The University of Texas at Austin)
- B25 Novel polyimides with bulky tert-butyl and fluorine-containing side groups: gas permeation parameters and free volume**, Susanta Banerjee (Indian Institutes of Information Technology); Nikolay Belov (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences); Roman Nikiforov (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences); Mikhail Mazo (Institute of Chemical Physics, Russian Academy of Sciences); Ivan Strelnikov (Institute of Chemical Physics, Russian Academy of Sciences); Yury P Yampolskii (A.V. Topchiev Institute of Petrochemical Synthesis, Russian Academy of Sciences)\*
- B26 New mixed matrix composite membrane PEBAX based membrane incorporated with metal organic framework for CO<sub>2</sub> separation**, Tarik Eljaddi (Laboratoire Réactions et Génie des Procédés)\*; Julien Bouillon (Normandie University); Laurent Lebrun (Normandie University)
- B27 Dual-Layer MOF Composite Membranes with Tunable Gas Transport Properties for Post-combustion CO<sub>2</sub> Separation**, Sameh K Elsaïdi (U.S. Department of Energy National Energy Technology Laboratory)\*; David Hopkinson (U.S. Department of Energy National Energy Technology Laboratory); Surendar Venna (U.S. Department of Energy National Energy Technology Laboratory); Mona Mohamed (University of Pittsburgh)
- B28 Performance of Pd-Based Membranes and Effects of Various Gas Mixtures on H<sub>2</sub> Permeation**, Kourosh Kian (Worcester Polytechnic Institute)\*

## SESSION C - Innovation in Membrane Materials, Synthesis, and Characterization: Liquids ...pg. 100

- C1 Layer-by-layer modification of aliphatic polyamide anion-exchange membranes to increase chloride/sulfate selectivity**, Muhammad Ahmad (University of Notre Dame)\*; Chao Tang (University of Notre Dame); Liu Yang (University of Notre Dame); Andriy Yaroshchuk (Polytechnic University of Catalonia); Merlin Bruening (University of Notre Dame)
- C2 Development of electrically conductive hollow fiber membranes**, Melissa J Larocque (McMaster University)\*, David R Latulippe (McMaster University), Charles-François de Lannoy (McMaster University)
- C3 Structure Formation in Isoporous Hollow Fiber Membranes: An In Situ SAXS study**, Kirti Sankhala (Helmholtz-Zentrum Geesthacht)\*; D. C. Florian Wieland (Helmholtz-Zentrum Geesthacht); Joachim Koll (Helmholtz-Zentrum Geesthacht); Maryam Radjabian (Helmholtz-Zentrum Geesthacht); Clarissa Abetz (Helmholtz-Zentrum Geesthacht); Volker Abetz (Helmholtz-Zentrum Geesthacht)
- C4 Microscopic membrane fouling characterization**, Nandini Debnath (University of Alberta); Alope Kumar (Indian Institute of Science); Thoams Thundat (The State University of New York at Buffalo); Mohtada Sadrzadeh (University of Alberta)\*
- C5 New Insights into the Impact of Nano-scale Surface Heterogeneity on the Wettability of Polymeric Membranes**, Md Farhad Ismail (University of Alberta); Behnam Khorshidi (University of Alberta); Mohtada Sadrzadeh (University of Alberta)\*
- C6 A comparison of water and solute transport in ion exchange and desalination polymers**, Ryan Kingsbury (Membrion, Inc.); Jingbo Wang (UCLA); Mikayla D Armstrong (University of North Carolina at Chapel Hill)\*; Orlando Coronell (University of North Carolina at Chapel Hill)
- C7 Water permeation through nanoporous particles in thin film nanocomposite membranes**, Pinar Cay-Durgun (Arizona State University)\*; Mary Laura Lind (Arizona State University)
- C8 Printing Membranes: Enabling the Use of Both Conventional and Novel Polymers in High Performance Membranes**, Jeffrey R McCutcheon (University of Connecticut); Ayse Asatekin (Tufts University); Maqsood Chowdhury (University of Connecticut); Xin Qian (University of Connecticut); Tulasi Ravindran (University of Connecticut)\*; Samuel Loudner (Tufts University)
- C9 Functionalization of PVDF Membranes with Thiol Groups for Heavy-Metal Capture**, Ronald Vogler (University of Kentucky)\*; Md. Saiful Islam (University of Kentucky); Evan Hatakeyama (Chevron Energy Technology Company); DB Bhattacharyya (University of Kentucky)
- C10 Pure and mixed fluid sorption and transport in Celazole® polybenzimidazole: the effect of plasticization**, Kelly P Bye (University of Oklahoma); Michele Galizia (University of Oklahoma)\*
- C11 Enhanced Water Interaction and Antifouling Compatible Zwitterion-PVDF Membrane Designs**, Mahboobeh Maghami (University of Saskatchewan); Amira Abdelrasoul (University of Saskatchewan)\*
- C12 Novel strategy to develop a composite membrane for desalination by membrane distillation**, Tarik Eljaddi (Laboratoire Réactions et Génie des Procédés - UMR 7274)\*; Deisy Mejia Mendez (Laboratoire Réactions et Génie des Procédés - UMR 7274); Eric Favre (Laboratoire Réactions et Génie des Procédés - UMR 7274); Denis Roizard (Laboratoire Réactions et Génie des Procédés - UMR 7274)
- C13 One-Step Tailoring Surface Roughness and Surface Energy to Prepared Superhydrophobic Polyvinylidene Fluoride (PVDF) Membranes for Enhanced Membrane Distillation Performances**, Weihua Qing (The University of Hong Kong)\*; Xiaonan Shi (New Jersey Institute of Technology); Chuyang Tang (University of New South Wales)
- C14 High-Performance Thin Film Composite (TFC) Membranes: Design Consideration Underneath the Polyamide Thin Film**, Wangxi Fang (Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences)\*; Jian Jin (Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences); Rong Wang (Singapore Membrane Technology Centre, Nanyang Technological University)

- C15 Wafer-Scale, Vertically-Aligned SWCNT Composite Membranes for Nanofiltration**, Melinda L Jue (Lawrence Livermore National Laboratory)\*; Chiatai Chen (Cornell University); Steven Buchsbaum (Lawrence Livermore National Laboratory); Eric Meshot (Lawrence Livermore National Laboratory); Sei Jin Park (Lawrence Livermore National Laboratory); Kuang Jen Wu (Lawrence Livermore National Laboratory); Francesco Fornasiero (Lawrence Livermore National Laboratory)
- C16 Vapor Phase Infiltration of Metal Oxides into Microporous Polymers for Solvent Stable Nanofiltration Membranes**, Fengyi Zhang (Georgia Institute of Technology)\*; Emily McGuinness (Georgia Institute of Technology); Yao Ma (Georgia Institute of Technology); Mark Losego (Georgia Institute of Technology); Ryan Lively (Georgia Institute of Technology)
- C17 Understanding the Interlayer-spacing and Mass Transport Nexus of Graphene Oxide Membrane for Organic Solvent Nanofiltration**, Sunxiang Zheng (UC Berkeley)\*; Baoxia Mi (UC Berkeley)
- C18 Organic-inorganic hybrid separation membrane having high chemical tolerance**, Koichi Takada (TORAY Industries, Inc.)\*; Takahiro Tokuyama (TORAY Industries, Inc.); Hiroki Minehara (TORAY Industries, Inc.); Takafumi Ogawa (TORAY Industries, Inc.); Masahiro Kimura (TORAY Industries, Inc.)
- C19 Magnetron Sputtering-based Synthesis of Pd film on UF membrane support for environmental catalysis**, Michael J Detisch (University of Kentucky)\*; DB Bhattacharyya (University of Kentucky); John Balk (University of Kentucky)
- C20 Influences of polymeric additives in different solvent systems on membrane performance and fouling resistance**, Catharina Kahrs (Leibniz University Hannover)\*; Jan Schwellenbach (Sartorius Stedim Biotech GmbH)
- C21 Porous membranes with synergic solvent and thermal resistance from polyoxindole derivatives**, Bruno Pulido Ponce de Leon (King Abdullah University of Science and Technology)\*; Suzana Nunes (King Abdullah University of Science and Technology)
- C22 Functionalized random zwitterionic copolymers as chlorine- and fouling-resistant nanofiltration membranes**, Samuel J Lounder (Tufts University)\*; Ayse Asatekin (Tufts University)
- C23 Deterioration of nanofiltration polyamide membrane by strong acid and its mechanism**, Byung-Moon Jun (University of South Carolina); Hyung Kae Lee (Ulsan National Institute of Science and Technology); Young-Nam Kwon (Ulsan National Institute of Science and Technology)\*
- C24 Opening new doors: Epoxides as novel chemistry for interfacial polymerization**, Rhea Verbeke (Katholieke Universiteit Leuven)\*; Marijn Seynaeve (Katholieke Universiteit Leuven); Wouter Arts (Katholieke Universiteit Leuven); Elke Dom (Katholieke Universiteit Leuven); Ivo Vankelecom (Katholieke Universiteit Leuven)
- C25 Solution-diffusion with ion association: a non-mean-field model that successfully describes NF of multi-ion mixtures**, Viatcheslav Freger (Technion - Israel Institute of Technology)\*
- C26 Relative permittivity properties of hydrated polymer membranes for desalination applications**, Kevin Chang (University of Virginia)\*; Hongxi Luo (University of Virginia); Geoffrey M Geise (University of Virginia)
- C27 Multi-solute transport behavior of aqueous mixtures through polyether-based membranes**, Jung Min Kim (Auburn University)\*; Bryan S Beckingham (Auburn University)
- C28 Comparative analysis of novel covalent organic framework nanofiltration membranes synthesis, composition, thickness and substrate dependence**, Gabrielle Levato (University of Illinois at Urbana-Champaign)\*; David Burke (Northwestern University); Zhiwei Jiang (Imperial College London); Daniel Mosiman (University of Illinois at Urbana-Champaign); William Dichtel (Northwestern University); Andrew Livingston (Imperial College London); Benito Marinas (University of Illinois at Urbana-Champaign)
- C29 Copper-MOF Functionalized Nanofiltration Membranes for Enhanced Dye Removal: Effects of Dip-Coating and In-Situ Modification Techniques**, Mostafa Dadashi Firouzjaei (University of Alabama); Zane Joseph Parkerson (University of Alabama); Milad Rabbani Esfahani (University of Alabama)\*

- C30 Advancing Conductivity-Permselectivity Tradeoff of Ion-Exchange Membranes with Sulfonated CNT Nanocomposites**, Hanqing Fan (Columbia University)\*; Yuxuan Huang (Columbia University); Ngai Yin Yip (Columbia University)
- C31 Ceramic-supported thin film composite membrane for organic solvent reverse osmosis**, Mi Zhang (University of Connecticut)\*; Lingling Xia (University of Connecticut); Jeffrey R McCutcheon (University of Connecticut); Marcus Weyd (Fraunhofer-Institut für Keramische Technologien und Systeme)
- C32 Dynamic FO tests of commercial low pressure RO TFC membrane**, Du Bai (University of Ottawa); Farhad Asempour (University of Ottawa); Boguslaw Kruczek (University of Ottawa)\*
- C33 New generation recycled polystyrene membranes for industrial water purification using membrane distillation**, Machawe M Motsa (University of South Africa)\*; Bhekia Mamba (University of South Africa)
- C34 Advanced supported ionic liquid (SIL) membranes for  $\pi$  electron cloud mediated separation of aromatics**, Mahmood Jebur (University of Arkansas); Arijit Sengupta (University of Arkansas); Ranil Wickramasinghe (University of Arkansas)\*
- C35 Graphene Oxide Membranes for Selective Molecular Separation of Lignin Model Compounds**, Ashish Aher (University of Kentucky)\*; DB Bhattacharyya (University of Kentucky)
- C36 High Flux and Anti-fouling Electrospun Nylon 6 Ultrafiltration Membrane Coated with GO/N-carboxyethylchitosan (NCECS) Functionalized Polyvinyl Alcohol Hydrogel**, Liuqing Yang (Concordia University)\*; Tiantian Chen (Concordia University); Zhibin Ye (Concordia University); Benoit Barbeau (Polytechnique Montreal); Saifur Rahaman (Concordia University)
- C37 Development and Characterization of  $nZnV/TiO_2$  Supported Membranes for Photocatalytic Treatment of 1,4-Dioxane in Water**, Larissa L. S. Silva (Federal University of Rio de Janeiro)\*; Wael Abdelraheem (University of Cincinnati); Minghao Kon (University of Cincinnati); Mallikarjuna Nadagouda (Wright State University); Ana Maria Rocco (Federal University of Rio de Janeiro); Cristiano Borges (Federal University of Rio de Janeiro); Fabiana Fonseca (Federal University of Rio de Janeiro); Dionysios Dionysiou (University of Cincinnati)
- C38 Oxone Mediated TEMPO-Oxidized Nanocellulose Form-I and Form-II: Materials, Membranes and Modeling**, John P Moore (University of Arkansas)\*
- C39 Facile Fabrication of Amphiphobic Nanocomposite Membranes for Application in Membrane Distillation**, Tiantian Chen (Concordia University); Liuqing Yang (Concordia University); Saifur Rahaman (Concordia University)\*
- C40 Graphene Oxide Nanoplatelets Embedded Polyamide Thin Films for Water Desalination**, Mahsa Abbaszadeh (Mississippi State University)\*; Santanu Kundu (Mississippi State University)
- C41 Development of Isoporous 0.2 Micron Nanoslit Silicon Nitride Membranes for Sterile Filtration of Biological Therapeutics**, Evan Wright (McMaster University); Joshua Miller (Simpore); Andrew Gosselin (Simpore); Jared Carter (Simpore); James McGrath (University of Rochester); David Latulippe (McMaster University); James Roussie (Simpore)\*

#### SESSION D - Innovation in Membranes for Energy Applications ...pg. 113

- D1 A membrane to separate light olefins and paraffins; an update on pilot trials, module design and C4 separations**, Ken Loprete (Compact Membrane Systems)\*; Bill Charlton (Compact Membrane Systems); Hannah Murnen (Compact Membrane Systems); Kenneth Pennisi (Compact Membrane Systems); Sudip Majumdar (Compact Membrane Systems)
- D2 Cross-linked Polyethyleneimine (XLPEI) with superior  $H_2/CO_2$  separation properties**, Sankhajit Pal (The State University of New York at Buffalo)\*; Weiguang Jia (The State University of New York at Buffalo); Haiqing Lin (The State University of New York at Buffalo)



- D3 Self-Cleaning Nanocomposite Membranes with Phosphorene-Based Pore Fillers for Water Treatment**, Joyner Eke (University of Kentucky)\*; Isabel Escobar (University of Kentucky)
- D4 Scale-up of A Catalytic Membrane Reactor for the Production of 5-Hydroxymethylfurfural from Lignocellulosic Biomass**, Tanmoy Patra (University of Arkansas); Robert Beitle (University of Arkansas); Richard J. Ciora, Jr. (Media and Process Technology, Inc.); Ranil Wickramasinghe (University of Arkansas); Xianghong Qian (University of Arkansas)\*
- D5 Thin-Film Composite Hollow Fiber Membrane for Post-Combustion Carbon Capture**, Shouliang Yi (U.S. Department of Energy National Energy Technology Laboratory)\*; James S Baker (U.S. Department of Energy National Energy Technology Laboratory); Ali Sekizkardes (Battelle/U.S. Department of Energy National Energy Technology Laboratory); Surendar Venna (U.S. Department of Energy National Energy Technology Laboratory); Victor A Kusuma (U.S. Department of Energy National Energy Technology Laboratory); Fangming Xiang (U.S. Department of Energy National Energy Technology Laboratory); Lingxian Zhu (U.S. Department of Energy National Energy Technology Laboratory); Hyuk Kwon (U.S. Department of Energy National Energy Technology Laboratory); David Hopkinson (U.S. Department of Energy National Energy Technology Laboratory); Kevin Resnik (U.S. Department of Energy National Energy Technology Laboratory)
- D6 Salinity gradient heat engine: optimising reverse electrodialysis for thermal-to-electric**, Anna Hulme (Cranfield University)\*
- D7 Use of desalination brine for low-energy concentration of orange juice via forward osmosis**, Haley D White (Tennessee Technological University)\*; Leif Templeton (Tennessee Technological University); Shelby Jones (Tennessee Technological University); Laura H Arias Chavez (Tennessee Technological University)
- D8 High-performance SSZ-13 membranes for CO<sub>2</sub> and N<sub>2</sub> removals from natural gas**, Rongfei Zhou (Nanjing Technical University)\*; Xinping Li (Nanjing Technical University); Bin Wang (Nanjing Technical University)
- D9 Highly efficient CO<sub>2</sub> capture by mixed matrix membranes containing three-dimensional covalent organic framework fillers**, Youdong Cheng (National University of Singapore)\*; Dan Zhao (National University of Singapore)
- ~~**D10 Industrially relevant membrane testing and novel mixed-matrix membranes for a brighter membrane future**, Raymond Thür (Katholieke Universiteit Leuven)\*~~
- D11 Torlon® Hollow Fiber Membranes for Organic Solvent Reverse Osmosis separation of Complex Aromatic Hydrocarbon Mixtures**, Hye Youn Y Jang (Georgia Institute of Technology)\*; Ryan Lively (Georgia Institute of Technology); JR Johnson (ExxonMobil); Dhaval Bhandari (ExxonMobil)
- D12 Performance Investigation of Polymer Derived Ceramic Composite Membrane in Microbial Fuel Cell (MFC)**, Vignesh Ahilan (University of Bremen)\*; Camila Cabral de Barros (University of Bremen); Gourav Dhar Bhowmick (Indian Institute of Technology); Makarand M Ghangrekar (Indian Institute of Technology); Michaela Wilhelm (University of Bremen); Kuroschi Rezwan (University of Bremen)
- D13 PIM-1 based polymeric blend membranes for gas separation applications**, Ashley Miles (Oak Ridge Associated Universities/U.S. Department of Energy National Energy Technology Laboratory)\*; Ali Sekizkardes (Battelle/U.S. Department of Energy National Energy Technology Laboratory); Janice Steckel (U.S. Department of Energy National Energy Technology Laboratory); David Hopkinson (U.S. Department of Energy National Energy Technology Laboratory)
- D14 The dynamic fate of Organic micro-pollutants in MBR and their accumulation in fish tissue**, Gal Dagan (Ben-Gurion University of the Negev)\*; Inbal Zaibel (Ben-Gurion University of the Negev); Dina Zilberg (Ben-Gurion University of the Negev); Moshe Herzberg (Ben-Gurion University of the Negev)
- D15 Improving H<sub>2</sub> Utilization of Solid Oxide Fuel Cell Using CO<sub>2</sub>-Selective Membrane**, Kai Chen (Ohio State University)\*; Witopo Salim (Ohio State University); Yang Han (Ohio State University); Mike Gasda (Bloom Energy Corporation); Winston Ho (Ohio State University)
- D16 Adapting a Blood CO<sub>2</sub> Removal Device for CO<sub>2</sub> Removal from Flue Gas**, Katherine Hornbostel (University of Pittsburgh)\*

- D17 Experimental study of dehumidification potential of PDMS hollow fiber membrane for HVAC applications,** Michelle K Croal (Oakland University); Jonathan Maisonneuve (Oakland University)\*
- D18 The Perfluoropolymer Upper Bound,** Albert Wu (MIT)\*; James Drayton (MIT); Zach Smith (MIT)
- D19 Synthesis and characterization of catalytic PtNa-PdAu membranes for hydrogen production,** Ana M Tarditi (Instituto de Investigaciones en Catálisis y Petroquímica)\*; Laura Cornagliia (Instituto de Investigaciones en Catálisis y Petroquímica); Yohana Martínez Galeano Instituto de Investigaciones en Catálisis y Petroquímica)
- D20 Hybrid facilitated transport membranes containing 2D GO-based nanoplatelets and scaffolds for CO<sub>2</sub> separation,** Saravanan Janakiram (Norwegian University of Science and Technology)\*; Juan Luis Martín Espejo (Norwegian University of Science and Technology); Zhongde Dai (Norwegian University of Science and Technology); Luca Ansaloni (SINTEF Industry); Liyuan Deng (Norwegian University of Science and Technology)
- D21 Current Efforts in Harvesting Algae At-Scale For Biofuels to Meet the Dual Energy Challenge,** Mark A Deimund (ExxonMobil Research and Engineering)\*
- D22 Atomically-Ordered Intermetallic Hydrogen Separation Membranes,** Casey O'Brien (University of Notre Dame)\*
- D23 Molten Hydroxide Dual-Phase Membranes for Intermediate-temperature Fuel Cells,** Vedasri Vedharathinam (Lawrence Livermore National Laboratory)\*; Anna Ivanovskaya (Lawrence Livermore National Laboratory); Maira Ceron Hernandez (Lawrence Livermore National Laboratory); Patrick Campbell (Lawrence Livermore National Laboratory)
- D24 High-Yield Recovery of Dissolved Methane Using Omniphobic Membranes,** Xuesong Li (University of British Columbia); Abhishek Dutta (University of British Columbia); Qirong Dong (Fibrecast); Sasha Rollings-Scattergood (Anaergia); Jongho Lee (University of British Columbia)\*
- D25 Aging minimization of CMSMs from the incorporation of copper pillars derived from metal organic polyhedra-18,** Whitney Cosey (University of Texas at Dallas)\*; Inga Musselman (University of Texas at Dallas); John Ferraris (University of Texas at Dallas); Kenneth Balkus (University of Texas at Dallas)
- D26 (Cross-linked Poly(ionic liquid)-Ionic Liquid-Zeolite) Mixed-Matrix Membranes for CO<sub>2</sub>/CH<sub>4</sub> Gas Separations Based on Curable Ionic Liquid Prepolymers,** Collin A Dunn (University of Colorado Boulder)\*; Zhangxing Shi (University of Colorado Boulder); Rongfei Zhou (Nanjing Technical University); Douglas Gin (University of Colorado Boulder); Richard Noble (University of Colorado Boulder)
- D27 Integral hollow fiber membrane with chemical cross-linking for pressure retarded osmosis operated in the orientation of active layer facing feed solution,** Ye Li (Nanyang Technological University)\*; Rong Wang (Nanyang Technological University)
- D28 GHG separation membrane application in KOGAS LNG regasification facilities,** Kyung Taek Woo (Korea Gas Corporation)\*; Hyun Seok You (Korea Gas Corporation); Jong Tae Chung (Korea Gas Corporation); Jae Dong Kim (Korea Gas Corporation)
- D29 High performance electrochemical structures for power generation and oxygen separation,** Ralph A Bauer (Global Research and Development Inc.)\*
- D30 Techno-economic comparison of RO and MD for small-scale brackish water desalination,** Haamid S Usman (Concordia University)\*; Khaled Touati (Concordia University); Saifur Rahaman (Concordia University)
- D31 Tailor-made amphiphilic copolymer membranes for efficient gas and water vapor transport,** Faheem Hassan Akhtar (King Abdullah University of Science and Technology)\*; Klaus-Viktor Peinemann (King Abdullah University of Science and Technology)
- D32 High-Temperature and High-Pressure Permeability-Selectivity Upper Bounds for Gas Separation Membranes Prepared From High Performance Polymers,** Edson V Perez (The University of Texas at Dallas)\*; Kenneth Balkus, Jr. (The University of Texas at Dallas); John Ferraris (University of Texas at Dallas); Inga Musselman (The University of Texas at Dallas)

- D33 Synthesis and Characterization of Anion Exchange Membranes based on Semi-Crystalline Poly(Ethylene-block-Styrene-block-Ethylene) Triblock Copolymer**, Carrie Trant (Rensselaer Polytechnic Institute)\*; Chulsung Bae (Rensselaer Polytechnic Institute); Sangwoo Lee (Rensselaer Polytechnic Institute)
- D34 Effect of Polyvinylamine Content on the CO<sub>2</sub> Separation Performance of Facilitated Transport Membranes**, James S Baker (U.S. Department of Energy National Energy Technology Laboratory)\*; Victor A Kusuma (U.S. Department of Energy National Energy Technology Laboratory); David Hopkinson (U.S. Department of Energy National Energy Technology Laboratory)
- D35 Effect of organic ballast properties on the energy efficiency of a concentration gradient flow battery**, Fei Liu (University of North Carolina at Chapel Hill)\*; Ryan Kingsbury (Membrion, Inc.); Jeromy Rech (University of North Carolina at Chapel Hill); Wei You (University of North Carolina at Chapel Hill); Orlando Coronell (University of North Carolina at Chapel Hill)

### SESSION E - Innovation in Membranes for Water Treatment ... pg. 124

- E1 Feasibility of long-term treatment of malting wastewater in a submerged anaerobic membrane bioreactor (SANMBR) at psychrophilic temperature conditions**, Esmat Maleki (Lakehead University)\*; Baoqiang Liao (Lakehead University)
- E2 Biofouling in ultrafiltration process for drinking water treatment and its control by chlorinated-water and pure water backwashing**, Shao Senlin (The University of Hong Kong)\*
- E3 Membrane Distillation of High Salinity Water by Induction Heated Thermally Conducting Membranes**, Avner Ronen (Temple University)\*; Arezou Anvari (Temple University)
- E4 Bromide Removal from Drinking Water Source Impacted by Energy Wastewater Discharge Using Electrically Conductive Membranes**, Avner Ronen (Temple University)\*; Mei Sun (University of North Carolina at Charlotte); Kartikeya Kekre (Temple University)
- E5 A surface modification of forward osmosis (FO) membranes to enhance dye retention and fouling resistance for the treatment of textile wastewater**, Sara Azari (Sterlitech)\*; Mohammd Karimi (Amirkabir University of Technology)
- E6 Evaluation of surface, bulk and electrochemical properties of Ti3C2Tx membranes used for selective ion removal from brine.**, Yousuf Z Bootwala (Georgia Institute of Technology)\*; Wahiduz Zaman (Vanderbilt University); Kelsey Hatzell (Vanderbilt University); Marta Hatzell (Georgia Institute of Technology)
- E7 Microwave-enhanced Membrane Filtration for Water Treatment**, Wanyi Fu (New Jersey Institute of Technology)\*; Wen Zhang (New Jersey Institute of Technology)
- E8 Application of Nanofiltration (NF) Membranes for Perfluoroalkyl and Polyfluoroalkyl substances (PFAS) Removal**, Daniel G Kulas (Michigan Technological University)\*; Andre da Costa (Michigan Technological University); Ananya Ananya (Michigan Technological University); Sam Jacobs (Michigan Technological University)
- E9 Development of membrane synthesis and novel draw materials for forward osmosis process**, Yusak Hartanto (Katholieke Universiteit Leuven)\*
- E10 3D Printed Self-Assembled Zwitterionic Copolymer Membranes**, Xin Qian (University of Connecticut)\*; Samuel J Louder (Tufts University); Ayse Asatekin (Tufts University); Jeffrey R McCutcheon (University of Connecticut)
- E11 Antifouling and Antiwetting Janus Membrane for Treating Hypersaline Oily Wastewater by Membrane Distillation**, Chenxi Li (University of British Columbia); Xuesong Li (University of British Columbia); Xuwei Du (Colorado State University); Tiezheng Tong (Colorado State University); Tzahi Cath (Colorado School of Mines); Jongho Lee (University of British Columbia)\*

- E12 Treating Hydraulic Fracturing Produced Waters by Membrane Distillation**, Ranil Wickramasinghe (University of Arkansas)\*
- E13 Synthesis of Polystyrene-b-poly(solketal methacrylate) (PS-b-PSMA) Polystyrene-b-poly(glycerol methacrylate) (PS-b-PGMA) Block Copolymers for Isoporous Membranes**, Sarah Saleem (Helmholtz-Zentrum Geesthacht); Sofia Rangou (Helmholtz-Zentrum Geesthacht); Clarissa Abetz (Helmholtz-Zentrum Geesthacht); Brigitte Lademann (Helmholtz-Zentrum Geesthacht); Volkan Filiz (Helmholtz-Zentrum Geesthacht)\*; Volker Abetz (Helmholtz-Zentrum Geesthacht)
- E14 Uranium isolation and concentration using reactive membranes for nuclear forensics applications**, Abenazer W Darge (Clemson University); Timothy DeVol (Clemson University); Scott Husson (Clemson University)\*
- E15 Development of Nano-enabled Membrane Technology for Water Reuse in Agriculture**, Xingmao Ma (Texas A&M University); Yinghao Wen (Texas A&M University)\*; Jieming Yuan (Texas A&M University)
- E16 Detection of Electrically Conductive Membrane Fouling by Impedance Spectroscopy**, Nan Zhang (McMaster University)\*; Charles-François de Lannoy (McMaster University)
- E17 Stability of Polyamide Nanofiltration Membranes with Peracetic Acid/Hydrogen Peroxide Disinfection**, Mohsen Ghafari (State University of New York at Buffalo)\*; Boya Xiong (MIT); Ning Dai (State University of New York at Buffalo)
- E18 Fouling-Resistant Two-Dimensional (2D) Covalent Organic Framework Membranes for Industrial Water Reuse**, Phuoc Duong (University of Wyoming); Valerie Kuehl (University of Wyoming); Mohammad Afroz (University of Wyoming); John Hoberg (University of Wyoming); Bruce Parkinson (University of Wyoming); Katie D Li-Oakey (University of Wyoming)\*
- E19 Reduced-holey graphene oxide(r-HGO) membranes with enhanced water permeance for water purification**, Xiaoyi Chen (The State University of New York at Buffalo)\*; Liang Huang (The State University of New York at Buffalo); Zhihao Feng (The State University of New York at Buffalo); Janavi Gohil (The State University of New York at Buffalo); Haiqing Lin (The State University of New York at Buffalo)
- E20 A Comparison of PolarClean, Gamma-Valerolactone and their Mixture as Bio-derived Solvents for Polysulfone Membrane Fabrication**, Xiaobo Dong (University of Kentucky)\*; Halle Shannon (University of Kentucky); Isabel Escobar (University of Kentucky)
- E21 Filterability of crude oil emulsions stabilized by COREXIT 9500 dispersant**, Seyma Kucuk (Michigan State University); Charifa Hejase (Michigan State University)\*; Iryna Kolesnyk (National University of Kyiv-Mohyla Academy); Jia Wei Chew (Nanyang Technological University); Vlad Tarabara (Michigan State University)
- E22 Polyamide/CNT Thin Film Nanocomposite (TFN) Seawater RO Membranes with Improved Boron Rejection**, Aysa Guvensoy (Istanbul Technical University); Süer Kurklu Kocaoglu (Istanbul Technical University); Cansu Yildirim (Istanbul Technical University); Sadiye Volioğlu (Istanbul Technical University); S. Birgül Tantekin-Ersolmaz (Istanbul Technical University)\*
- E23 New generation of patterned membranes for water treatment**, Asad Asad (University of Alberta); Dan Sameoto (University of Alberta); Mohtada Sadrzadeh (University of Alberta)\*
- E24 Enhancing boron rejection on electrically conducting reverse osmosis membranes through local electrochemical pH modification**, Bongyeon Jung (UCLA)\*; David Jassby (UCLA)
- E25 Cellulose Triacetate Membrane Parameter Estimation Under Osmotic and Osmotic-Assisted Process Conditions**, Jacob L Weidman (U.S. Department of Energy National Energy Technology Laboratory/Oak Ridge Institute for Science and Education)\*; Sara Osipi (Federal University of Rio de Janeiro); Alexander V Dudchenko (Carnegie Mellon University); Meagan S Mauter (Carnegie Mellon University); Nicholas Siefert (U.S. Department of Energy National Energy Technology Laboratory)

- E26 Porous hydrophobic-hydrophilic composite flat and hollow fiber membranes for direct contact membrane distillation,** Aishwarya Puranik (New Jersey Institute of Technology); Lydia Rodrigues (New Jersey Institute of Technology); John Chau (New Jersey Institute of Technology); Lin Li (New Jersey Institute of Technology); Kamallesh K Sirkar (New Jersey Institute of Technology)\*; Ashok Sharma (Applied Membrane Technology Inc); Stephen Conover (Applied Membrane Technology Inc); Adam Juelfs (Applied Membrane Technology Inc); Connor Colling (Applied Membrane Technology Inc); Saket Sharma (Applied Membrane Technology Inc)
- E27 Polyamide-imide: a new platform for fabrication of oil/water separation membranes,** Nusrat Helali (University of Alberta); Masoud Rastgar (University of Alberta); Mohtada Sadrzadeh (University of Alberta)\*
- E28 Monolayer Graphene transfer onto polyvinyl alcohol (PVA) microfiltration membrane for water desalination.,** Mansour Saberi (Clemson University)\*
- E29 Membrane Distillation-Crystallization (MDC) for Maximum Water Recovery in Inland Desalination,** Evangelos Balis (University of Nevada, Reno); Sage Hiibel (University of Nevada, Reno)\*
- E30 Insights regarding thermomechanical bonding between porous membranes and thermoplastic polymers,** Masoud Aghajani (MAST Center, University of Colorado Boulder)\*; Adrienne Blevins (University of Colorado Boulder); Jason P. Killgore (National Institute of Standards and Technology); Ryan Sylvia (MilliporeSigma); Christina Carbrello (MilliporeSigma); Alan R. Greenberg (MAST Center, University of Colorado Boulder); Rong Long (MAST Center, University of Colorado Boulder); Yifu Ding (MAST Center, University of Colorado Boulder)
- E31 Ion exchange polymer coatings enhance solute rejection of polyamide thin-film composite membranes,** Mikayla D Armstrong (University of North Carolina at Chapel Hill)\*; Ryan Kingsbury (Membrion, Inc.); Kasia Grzebyk (University of North Carolina at Chapel Hill); Orlando Coronell (University of North Carolina at Chapel Hill)
- E32 Mechanical behaviour of the porous support of TFC membranes and its influence on the overall resistance,** Masoud Aghajani (University of Colorado Boulder)\*; Alan R. Greenberg (University of Colorado Boulder); Yifu Ding (University of Colorado Boulder)
- E33 Development of Membrane Distillation through Tuning Membrane Surface Properties and Module Design,** Siamak Nejati (University of Nebraska-Lincoln)\*; Mahdi Mohammadi (University of Nebraska-Lincoln); Mona Bavarian (University of Nebraska-Lincoln)
- E34 Integration of Forward Osmosis in the Treatment of Sewage by *Chlorella vulgaris*: Comparison between External and Immersed Systems,** Xue Jin (Oregon State University)\*; Mathieu Larronde-Larretche (University of Glasgow)
- E35 Nanoengineered condensation surfaces for air gap membrane distillation,** Yashwant S. Yogi (Purdue University); Sina Nejati (Purdue University); Akshay K. Rao (Purdue University); Rishav Roy (Purdue University); Abhimanyu Das, Longnan Li (University of Illinois, Urbana-Champaign); Soumyadip Sett (University of Illinois, Urbana-Champaign); John Lienhard (MIT); Nenad Miljkovic (University of Illinois, Urbana-Champaign); Justin A. Weibel (Purdue University); Jaichander Swaminathan (Massachusetts Institute of Technology); David Warsinger (Purdue University)\*
- E36 Fouling of Anion Exchange Membranes in Ferric Chloride Solutions: mechanism and the role of ion exchange capacity, water content, and pore structure,** Michael J. McGrath (University of Colorado Boulder)\*; Nicholas Patterson (UC San Diego); Bryce Manubay (University of Colorado Boulder); Hans Funke (University of Colorado); Samantha Hardy (University of Colorado Boulder); Andrew Basalla (University of Colorado Boulder); Xiujun Yue (UC San Diego); Ping Liu (UC San Diego); Douglas Gin (University of Colorado Boulder); Richard Noble (University of Colorado Boulder)

## SESSION F - Innovation in Modeling of Membrane Fundamentals and Processes ...pg 135

- F1 Molecular Dynamics Processing Tool for Transmembrane Simulations,** Jia Lin Cheoh (Purdue University)\*; Abhimanyu Das (Purdue University); David Warsinger (Purdue University)

- F2 Low energy-consumption pre-treatment system for integrated forward osmosis - reverse osmosis desalination process**, Yunchul Woo (Korea Institute of Civil Engineering and Building Technology)\*; June-Seok Choi (Korea Institute of Civil Engineering and Building Technology); Kwang-Duk Park (Korea Institute of Civil Engineering and Building Technology)
- F3 Arrested mobility effects on the spinodal decomposition of ternary polymer solutions for immersion precipitation**, Jan Garcia (UC Santa Barbara)\*; Douglas Tree (Brigham Young University); Kris Delaney (UC Santa Barbara); Glenn Fredrickson (UC Santa Barbara)
- F4 Hydro- and perfluoro-carbon sorption, diffusion and permeation modeling in poly(dimethylsiloxane) using a PC-SAFT Equation of State**, Liang Liu (The University of Melbourne)\*
- F5 The Potential of Low-Temperature Forward Osmosis for Water Recovery**, Jeffrey Martin (University of Toronto); Georgios Kolliopoulos (University of Toronto); Vladimiro Papangelakis (University of Toronto)\*
- F6 Fouling mechanisms in constant flux crossflow ultrafiltration**, Alon Kirschner (The University of Texas at Austin)\*; Yu-Heng Cheng (The University of Texas at Austin); Donald Paul (The University of Texas at Austin); Robert Field (University of Oxford); Benny Freeman (The University of Texas at Austin)
- F7 Hitz zeolite membrane separation system (HDS) for liquid separation**, Akira Hamasaki (Hitachi Zosen Corporation)\*
- F8 Effect of short-term contact with C1-C4 alcohols on the water permeance and salt rejection of MPD-TMC thin-film composite reverse osmosis membranes**, Jaime A Idarraga-Mora (Clemson University)\*; Michael Lemelin (Clemson University); Steven Weinman (Clemson University); Scott Husson (Clemson University)
- F9 Whey recovery using forward osmosis with hollow fiber configuration - Evaluating the factors limiting the flux performance**, YiNing Wang (Nanyang Technological University)\*; Rong Wang (Nanyang Technological University)
- F10 Bimetallic Nanoparticles Incorporated Poly(methacrylic acid) Functionalized Membranes for Water Remediation: Synthesis, Advanced Characterization and Reactive Properties**, Hongyi (Derek) Wan (University of Kentucky)\*; Md. Saiful Islam (University of Kentucky); Nicolas Briot (University of Kentucky); Anthony Saad (University of Kentucky); Lindell Ormsbee (University of Kentucky); DB Bhattacharyya (University of Kentucky)
- F11 Membrane compaction in forward osmosis process**, Daniel Yee Fan Ng (Nanyang Technological University); Yunfeng Chen (Nanyang Technological University); Rong Wang (Nanyang Technological University)\*; Zhili Dong (Nanyang Technological University)
- F12 Novel Isothermal Acid Sweep Membrane Distillation for Selective and Energy Efficient Removal and Recovery of Ammonia**, Stephanie N McCartney (Columbia University)\*; Natalie Williams (Columbia University); Chanhee Boo (Columbia University); Ngai Yin Yip (Columbia University)
- F13 In-situ micro-rheology of a foulant layer**, Jose Agustin Epstein (Technion - Israel Institute of Technology); Guy Z Ramon (Technion - Israel Institute of Technology)\*
- F14 Mixed-gas permeation in thermally rearranged poly(benzoxazole-co-imide) polymer membranes**, Adele Brunetti (Institute on Membrane Technology of Italian National Research Council); Elena Tocci (Institute on Membrane Technology of Italian National Research Council); Jong Geun Seong (Hanyang University); Young Moo Lee (Hanyang University)\*; Enrico Drioli (Institute on Membrane Technology of Italian National Research Council); Giuseppe Barbieri (Institute on Membrane Technology of Italian National Research Council)
- F15 Plug flow reactor IEMB - performance and modelling**, Shalom Fox (Ben-Gurion University of the Negev); Kristina Stadnik (Ben-Gurion Univ.); Amit Thakur (Ben-Gurion University of the Negev); Zeev Ronen (Ben-Gurion Univ.); Yoram Oren (Ben-Gurion University of the Negev); Jack Gilron (Ben-Gurion University of the Negev)\*
- F16 Isolation of Extracellular Vesicles from a Biofluid Using Ultrathin Microslit and Nanopore Silicon Membranes**, Jared Carter (SiMPore inc.)\*; Cassandra Walinski (SiMPore Inc.); Akash Patel (SiMPore Inc.); Joshua Miller (SiMPore Inc.); Jon-Paul DesOrmeaux (SiMPore Inc.); James A Roussie (SiMPore Inc.)

- F17 High-Pressure Reverse Osmosis for Energy-Efficient Desalination of High Salinity Brines**, Douglas M Davenport (Yale University)\*; Akshay Deshmukh (Yale University); Jay Werber (Yale University); Yuhao Du (Yale University); Menachem Elimelech (Yale University)
- F18 Computationally Efficient Methods of Simulating Membrane Spacers**, Jacob Johnston (Colorado School of Mines)\*; Jincheng Lou (Colorado School of Mines); Nils Tilton (Colorado School of Mines)
- F19 Dissipative Particle Dynamics Simulations of PES membrane via NIPS**, Eric Ledieu (University of Arkansas)\*; Yuanhui Tang (University of Arkansas); Rosario Cervellere (University of Arkansas); Paul Millett (University of Arkansas); David Ford (University of Arkansas); Xianghong Qian (University of Arkansas)
- F20 Leveraging Surplus Energy from Nuclear Power Generation for Seawater Desalination: A Process Modelling Investigation**, J. Hunter Himes (Tennessee Tech University); Mary Adkisson (Tennessee Tech University); Laura H Arias Chavez (Tennessee Tech University)\*
- F21 Maxwell-Stefan characterization of surface diffusion flow through defect containing silicalite membranes.**, David Carter (University of Ottawa); Shaaïma Al Akwaa (University of Ottawa); Boguslaw Kruczek (University of Ottawa); Handan Tezel (University of Ottawa)\*
- F22 Self-Regulating FO-RO Hybrid Systems**, Noah Ferguson (University of Connecticut)\*; Nicole Beauregard (University of Connecticut); Jeffrey R McCutcheon (University of Connecticut)
- F23 Estimating salt diffusion coefficients in polyamide active layers of reverse osmosis membranes using microscale continuum modeling**, Riley Vickers (University of North Carolina at Chapel Hill)\*; Jingbo Wang (UCLA); Timothy Weigand (University of North Carolina at Chapel Hill); Casey Miller (University of North Carolina at Chapel Hill); Orlando Coronell (University of North Carolina at Chapel Hill)
- F24 Energy-efficient Biogas Upgrading Membrane Process**, Chung-Seop Lee (Airrane Co. Ltd); Jinhyuk Lim (Airrane Co. Ltd); Sang Hoon Han (Airrane Co. Ltd)\*; Sejong Kim (Airrane Co. Ltd); Seong Yong Ha (Airrane Co. Ltd); Won Seok Chang (Korea District Heating Corporation); Moon Sei Oh (Korea District Heating Corporation)
- F25 Multi-stage Membrane Process for CO<sub>2</sub> Separation from LNG flue gas**, Chung-Seop Lee (Airrane Co. Ltd)\*; Sejong Kim (Airrane Co. Ltd); Chung-Seop Lee (Airrane Co. Ltd); Won Seok Chang (Korea District Heating Corporation); Moon Sei Oh (Korea District Heating Corporation)
- F26 Cost Optimization of Pressure Retarded Osmosis**, Alexandra N Newby (Carnegie Mellon University)\*; Timothy V Bartholomew (Carnegie Mellon University); Meagan S Mauter (Carnegie Mellon University)
- F27 Tearing propagation of an airship envelope fabric based on FEM and X-FEM methods**, Chen Yonglin (Shanghai Jiaotong University); Wang Fengxin (Shanghai Jiaotong University)\*
- F28 Modelling of the effect of current density and contact time in electro-coagulation on membrane fouling**, In-Soung Chang (Hoseo University)\*
- F29 Characterization and Molecular Dynamics Simulation of Poly(arylethersulfone) Ultrafiltration Hemodialysis Membrane**, Arash Mollahosseini (University of Saskatchewan); Amira Abdelrasoul (University of Saskatchewan)\*
- F30 Humidified gas permeabilities in polybenzimidazole gas separation membranes**, Joshua D Moon (The University of Texas at Austin)\*; Benny Freeman (The University of Texas at Austin); Donald Paul (The University of Texas at Austin)
- F31 Hollow Fiber Countercurrent Dialysis for Continuous Buffer Exchange of High Value Biotherapeutics**, Christopher Yehl (Penn State University)\*
- F32 Multiscale modeling of microporous polymer blends for CO<sub>2</sub> separation**, Alec Kaija (U.S. Department of Energy National Energy Technology Laboratory)\*; Ali Sekizkardes (Battelle/U.S. Department of Energy National Energy Technology Laboratory); Samir Budhathoki (U.S. Department of Energy National Energy Technology Laboratory); Janice Steckel (U.S. Department of Energy National Energy Technology Laboratory)